

Zero Retries issue 0193 2025-03-14

Zero Retries is an independent newsletter promoting technological innovation that is occurring in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2500+ subscribers.

About Zero Retries

Steve Stroh N8GNJ, Editor

Web version of this issue - <https://www.zeroretries.org/p/zero-retries-0193>

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Request To Send

Commentary by Editor Steve Stroh N8GNJ

Paid Subscribers Update

My thanks to **Tom Nolan W3EX** for *upgrading* from a free subscriber to Zero Retries to an **Annual Paid Subscriber** this past week!

My thanks to **Prefers to Remain Anonymous 67** for *upgrading* from a free subscriber to Zero Retries to an **Annual Paid Subscriber** this past week!

Financial support from Zero Retries readers is a significant vote of support for the continued publication of Zero Retries.

##

Light Week For News

I'm writing this issue of Zero Retries early in the week as my wife Tina KD7WSF and I are traveling to attend [HamSCI 2025](#). Thus this issue won't be very topical in covering events that occur during the week.

Update: Except for *major* developments like this week's FCC Public Notice - see below.

We're looking forward to the change of scenery and climate, being in New Jersey for a bit to attend HamSCI, do a bit of touring, catch up with some relatives, and an excursion to [Micro Center](#). And **bagels**... really, *really* good bagels!

###

Ephemera from Puyallup

As I feared, I collected *more* ephemera at the recent "Puyallup". The major find was another (used) Kenwood TH-F6A portable which in my opinion was the last great Amateur Portable Radio given that it operates on 144-148 / 222-225 / 440-450 MHz and it can also be used for higher speed data modes. I love that it's (mostly) sane to program from the keyboard. I also collected a radio / TNC combination which the seller all but begged me to take when I expressed some mild curiosity about it; it wouldn't be a good hamfest if I didn't collect at least one item of packet radio equipment. If it's a slow week in a couple of weeks, I'll include more details about the other ephemera. And I did find a decent amount of material for donation to DLARC.

###

Store and Forward Podcast Episode 11

My friend Kay Savetz K6KJN and I have done another episode of Store and Forward, [Episode 11 - Backing up the FCC](#). Kay explains the process of bulk archiving material that the FCC published on YouTube, and other important FCC information such as the FCC's Daily Digest, now securely archived with Internet Archive in the Digital Library of Amateur Radio & Communications. Kay had to invent some new systems for this work, and has my appreciation and admiration for this important work.

###

Any Zero Retries Readers Members of Radio Club of America?

Just curious if there are members of the [Radio Club of America](#) within the Zero Retries readership? If you are an RCA member, could you drop me an email? I'm just curious.

###

Have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

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Breaking News - From FCC - IN RE: DELETE, DELETE, DELETE

By Steve Stroh N8GNJ

In a formal FCC Public Notice - DA 25-219, Released: March 12, 2025, GN Docket No. 25-133, titled [IN RE: DELETE, DELETE, DELETE](#), the US FCC has formally requested comments on deleting FCC rules.

Comments Due: Friday, April 11, 2025

Reply Comments Due: Monday, April 28, 2025

Through a series of Executive Orders, President Trump has called on administrative agencies to unleash prosperity through deregulation and ensure that they are efficiently delivering great results for the American people.

By this Public Notice, the Federal Communications Commission (Commission or FCC) is taking action to promote the policies outlined by President Trump in those Executive Orders. Specifically, we are seeking public input on identifying FCC rules for the purpose of alleviating unnecessary regulatory burdens.

We seek comment on deregulatory initiatives that would facilitate and encourage American firms' investment in modernizing their networks, developing infrastructure, and offering innovative and advanced capabilities.

The Communications Act directs the FCC to regularly review its rules to identify and eliminate those that are unnecessary in light of current circumstances,² recognizing that in addition to imposing unnecessary burdens, unnecessary rules may stand in the way of deployment, expansion, competition, and technological innovation in communications that the Commission is directed to advance.⁴ Government-wide administrative law requires review of rules to ensure that unnecessary—or affirmatively detrimental—rules are not retained.

We encourage commenters to consider certain policy factors, as described below and consistent with standards and objectives set forth in recent Presidential orders as well as statutory and regulatory retrospective review standards. We also invite more general comment on rules that should be considered for elimination on other grounds. Submissions should identify with as much detail and specificity as possible the rule or rules that the commenting party believes should be repealed (or modified) and the rationale for their recommended action. Commenters whose comments raise issues related to other open Commission dockets should file their comments in all relevant dockets.

First... whatever your political leanings in US politics, this notice from the FCC isn't a joke or a spoof. This was downloaded from the FCC website. ***This***

IS happening.

Second, I don't think this can be ignored... and more to the point, I don't think *Amateur Radio and its spectrum* will be ignored.

I think this is a might be the only "seize the moment" chance for large scale reform in US Amateur Radio regulations in the 2020s.

Rather than "deregulation" I think this is a chance for *modernization* of the US Amateur Radio Service to remove overly proscriptive regulations that just don't make sense and aren't really needed in this era with microprocessor controlled radios that can be accurate on frequency to the single Hz.

To imagine what this would look like, see Bruce Perens K6BP's [comments to the FCC in 2017](#).

But more currently, a very timely article by Keith Baker KB1SF / VA3KSF in the August 2024 issue of [The Spectrum Monitor](#) - **A TSM Closer Look: US vs. Canadian Amateur Radio Licensing Systems** *directly addresses the scenario* in the FCC's IN RE: DELETE, DELETE, DELETE Public Notice. Despite being published eight months prior to this development at the FCC, KB1SF / VA3KSF's discussion seems exactly on target to address this FCC Public Notice.

The author and publisher graciously allowed this article to be made publicly available - see <https://archive.org/details/us-canadian-amateur-radio-licensing>.

Basically, KB1SF / VA3KSF makes the case that the extensive rewrite of the FCC Part 97 Amateur Radio regulations in the 1950s and 1960s were (perhaps) appropriate for that that era (and the technology of that era), but they make little sense in *this era*, especially when contrasted to the saner "know at least minimally what you're doing with radio systems, and know enough about the regulations" Amateur Radio licensing in other countries. The comparative "light touch" Amateur Radio regulations of Canada is illustrative of how "overbearing" US Amateur Radio regulations are in comparison.

KB1SF / VA3KSF's article explains the differences of the US Part 97 regulations, and some of the absurdities of Part 97, but it's not a blueprint for suggested changes in Part 97 (not the point of the article, which again, was published eight months ago).

Thus I hope that US Amateur Radio can come together create a framework of what to ask for from the FCC of this administration, and present a unified front to the FCC. This isn't a moment for headline grabbing, hand wringing (whether you support, or despise, the FCC for this action), public pontificating, tribalism of warring modes, etc.

One commenter to my initial email blast said:

I don't think anything good can come of this. We are just as likely to see homesteading of the amateur frequencies. I don't plan to participate in this.

To which I replied:

Honestly I don't think we have a choice to sit this one out. We're either going to proactively get engaged on this or we will get run over. Sitting it out and hoping other services or companies don't notice this moment to go after Amateur Radio, in my opinion, *isn't an option*.

Perhaps we need to form a new group - the **US Amateur Radio Modernization Task Force**?

I'll write more about this issue in next week's Zero Retries.

I, for one, plan to file comments, and reply comments to the FCC by the deadline. If, by necessity, mine are solely personal comments, they won't be great because a lot of the nuances and regulationese of Part 97 escapes me... but at least I'm going to try.

Lastly, we (US Amateur Radio) doesn't have much time for coming up with our comments:

Comments Due: Friday, April 11, 2025

Reply Comments Due: Monday, April 28, 2025

I really, really hope US Amateur Radio shows up for this one.

Leave a comment

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GNU Radio Conference 2025 in Everett, Washington, USA

By Steve Stroh N8GNJ



Image courtesy of GNU Radio

GNU Radio Conference will be held September 8-12, 2025.

GNU Radio Conference (GRCon) is the annual conference for the GNU Radio project and community, and has established itself as one of the premier industry events for Software Radio. It is a week-long conference that includes high-quality technical content and valuable networking opportunities. GRCon is a venue that highlights design, implementation, and theory that has been practically applied in a useful way. GRCon attendees come from a large variety of backgrounds, including industry, academia, government, and hobbyists. Offering an annual program with broad appeal, GRCon attracts a variety of participants: people new to software radio who are interested in learning more, seasoned developers ready to show off their latest work, and experts who want to keep their finger on the pulse and direction of the industry.

I could not be more delighted about this event being held in Everett, Washington! It couldn't get any more convenient than this. GRCons are big enough that they could have justified holding it at the (very large) Washington State Convention Center in downtown Seattle, but placing it in Everett, Washington just 30 miles North of Seattle (and 60 miles South of Bellingham, Washington, where we live) will make it a lot easier to get around.

This will undoubtedly pull in SDR enthusiasts and students from the entire Pacific Northwest - Portland, Seattle, Vancouver, and of course all the international attendees.

GNU Radio is [looking for help for this event](#) and also looking for sponsors:

If you have questions or would like to find out more about becoming one of our valued sponsors please contact us at grcon@gnuradio.org. Note that this event can only be successful because of our sponsors - please see the sponsors that made GRCon24 possible.

Since GRCon is run by a group of volunteers, we are also looking for people to help with both the planning of and assisting during the event. If you are interested in volunteering in any capacity, please reach out to us grcon@gnuradio.org.

My wife Tina KD7WSF and I have already sent our offer to volunteer with GRCon 25.

That will be a busy Zero Retries Interesting week, with the inaugural [M17 Conference 2025 to be held the prior weekend](#).

As for me, I am looking forward to a week of total immersion in Software Defined Radio technology. I will be (deep) over my head with the science, math, and programming of SDR technology, but that's OK... and I will love being back in drinking from a firehose mode like I was at the first Digital Communications Conferences that I attended back in the 1990s and learned so much from!

What's New at Digital Library of Amateur Radio & Communications — March 2025

By Kay Savetz K6KJN
Internet Archive's Program Manager, Special Collections

It's an interesting in-between time here at DLARC World Headquarters. As I repeat at every opportunity, Digital Library of Amateur Radio & Communications is funded by a grant from Amateur Radio Digital Communications (ARDC) to create a free digital library for the radio community, researchers, educators, and students. We've been working at this project for about two and a half years, and we've done work that I'm so proud of. The library has grown to 149,500 items. 19.5 terabytes of information. We scanned 1.1 million pages in 2024 alone. We've rescued, recovered, digitized, and made available material that would have been lost forever otherwise. And, we've spent the money! The ARDC's grant was generous, but not infinite.

I've applied for another grant, asking ARDC for funds to keep adding new material to DLARC for another two years. I don't know if we'll be awarded a second grant. I'm cautiously optimistic but certainly ARDC's grant committee has many other opportunities to benefit the ham radio community in other worthy ways. If we don't get additional funding, I know two things for sure: the material that's already in DLARC will remain online permanently, and that I am insanely proud of what the project has accomplished. If we're done, I will walk away with the knowledge that we've created something of long-lasting, real benefit to the ham radio community worldwide.

So, it's an interesting in-between time. I'm wrapping up projects, putting bows on collections to make them complete and pretty in case it's time to walk away. But also, I'm planning for the future, in case we do get to keep working.

In the mean time, here's some of what I've added to DLARC in the last month.

[1,300+ videos backed up](#) from the Federal Communications Commission's YouTube channel. Right now we can't trust the federal government to leave content online (every video in the Consumer Financial Protection Bureau's YouTube page was removed in February) so now DLARC has a copy of the FCC's YouTube channel. And for good measure, DLARC now also has a copy of [every FCC Daily Digest since 1994](#). The Daily Digest provides a brief synopsis of Commission orders, news releases, speeches, public notices and all other FCC documents that are released each business day. In addition to the digests themselves, DLARC has collected every document referenced in each Digest. Just in case.

We've scanned hundreds of issues of [The Logger's Bark](#), the newsletter of the Radio Club of Tacoma (in Washington State). These span 1963 through 2003, and were lovingly bound into volumes by the club over the years. The club lent us the one-of-a-kind, irreplaceable books to scan. The thickest one was 950 pages! We scanned it all, and now they're searchable, downloadable, and available to the world.

I also added 41 issues of the [Titusville \(Florida\) Amateur Radio Club](#) newsletter, and 22 recent issues of the [National Radio Club DX News](#) newsletter — bringing the total to 2,786(!) items from that group.

I updated the [International Radio Report collection](#). International Radio Report is a radio program about radio in Montreal and around the world. It has been published since 1987, but we have them going back to 2000. I added machine-generated summaries of every episode that didn't include official show notes from the show's creators. And, I freshened DLARC's collection of [Glenn Hauser's World of Radio](#). Published since 1980, the show explores communications from around the world, with a special focus on shortwave radio. Again, I added machine-generated summaries of every episode that needed one. They may not be perfect, but in the absence of human-written show notes, they're much better than nothing.

We've scanned nearly 1,000 Sams PhotoFacts folders from the estate of [Ron Patterson W6FM](#). These manuals provided repair information and schematics for all manner of radios, televisions, amplifiers, and other electronics. Each folder covers a dozen or more products. The repair possibilities are endless.

Finally, here's a treat of special interest to Zero Retries readers. Hank Magnuski KA6M sent to DLARC the source code to the digipeater that ran from his house in Menlo Park, California in 1980 and 1981. He explained to me "The file DGPTR.PAS.txt is a Pascal/Z program file that ran the repeater at launch. Pascal, a now forgotten programming language (one of about 26 programming languages I've used in my career), had a Z80 version. This was running on a Z80 micro-controller board with self-contained memory and no disk. It did not use CPM or DOS or anything similar. Maybe like an Arduino system today." Hank has open-sourced the code under the MIT License.

Even if you don't care to pore over old code, Hank included a document that he wrote ["On the Care and Feeding of your Packet Repeater"](#). It's a fascinating slice of early packet radio history. Here's a bit of it:

"From its initial turn-on in December, 1980, and through most of the Spring of 1981 the packet repeater was operating out of my residence in western Menlo Park, California, a location which is in the foothills which border the western shore of the San Francisco Bay. It was an experimental machine then, but could be heard well through most of the northern end of Silicon Valley, even though the power level was modest. The only station equipped to use it then was located in the same house, so there was never any real problem with signal path. Since then we have installed a couple of upgrades to the control software, we have used a better CPU card, increased the power level, moved the repeater up to a 700 ft. elevation, and integrated its operation to be 100% compatible with the protocol used by the Vancouver Digital Communications Group's terminal node controller. The repeater has changed from being a laboratory curiosity to a major Bay Area repeater heard from Marin/Berkeley to south San Jose, and the user community has grown from a couple of stations to a network approaching 30 users."

Digital Library of Amateur Radio & Communications is funded by a grant from Amateur Radio Digital Communications ([ARDC](#)) to create a free digital library for the radio community, researchers, educators, and students. If you have questions about the project or material to contribute, contact me at kay@archive.org.

Editor's Note - I, for one, am rooting for DLARC to receive another ARDC grant. I think that DLARC will be the longest enduring project funded by ARDC. Also, although I don't currently program in Pascal, when I did so (as a rank beginner), I became a fan of its sane syntax. Thus I beg to differ with Kay's characterization of Pascal as "Pascal, a now forgotten programming language". Pascal lives on in [Free Pascal](#) and other variants as discussed in the [Wikipedia article](#).

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Update on Oahu (Hawaii) Network of Multi-band APRS Digipeaters

By Jeffrey Komori KH6JUZ

Editor's Note - In *Zero Retries 0171* - 2024-09-27, I described a new network of multi-band APRS digipeaters on the island of Oahu, Hawaii, USA - A 144 / 222 / 440 MHz 9600 APRS Stack...and Network!

The goal of the [Jeffrey Komori] KH6JUZ's project is to improve APRS coverage on the island of Oahu, Hawaii, USA with a network of these units providing APRS service on 144.39 MHz at 1200 bps, and 9600 bps APRS service on the 144, 222, and 440 MHz bands.

At the time of that article, the various digipeater "stacks" were still being built and only prototype units had been deployed. I've stayed in touch with KH6JUZ about the status of deploying the "stacks", and he recently provided this update.

A couple of weeks ago, we swapped out the radio stack at our [Haleiwa site](#) but we've been having coverage issues since that swap and I'll need to go back out there to check on it; I'm hoping to get out there sometime within the next few weeks.

This past weekend, we've replaced the APRS radio stack at our [Maunawili](#) site with a new radio stack after that site went offline more than 6 months ago. It's now back to fully operational status with 144.39 @ 1200bps and 144.99, 223.65 & 433.1 @ 9600bps APRS.

We're in the process of ordering the tower arm extensions to mount a couple of vertical antennas (Diamond X700HNA & Comet CX-333) at our new site on the North Shore of Oahu ([Pupukea, home to the world-famous KH6YY](#) (formerly KH6XX) contest site). We're hoping to have that site online sometime within the next few months. With this site, we're hoping to begin providing APRS coverage to the most populated areas of the island of Kauai as well as the North Shore of Oahu.

I'm hoping to update the radio stack at our [Kapolei \(SouthWest Oahu\)](#) site sometime within the next few weeks; this will add 433.1 as well as 144.99 @ 9600bps APRS to the existing 144.39 @ 1200bps & 223.65 @ 9600bps.

We're looking for a Ham host site to add APRS in Wahiawa (Central Oahu); so, that site is an unknown, at this point.

We're also looking for a site in Laie (near the Polynesian Cultural Center) and am hoping we can find a willing Ham host in that area.

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The Threat to the US 902-928 MHz (33 cm) Band from NextNav

By Steve Stroh N8GNJ

I apologize in advance for the "My Eyes Glaze Over (MEGO) / Too Long; Didn't Read (TL;DR)" nature of all of the verbiage that follows in this article.

But, this how the removal of Amateur Radio privileges from various portions of spectrum occurs. In past such actions (and there have been many in the previous decades), I didn't have a platform to speak out to Amateur Radio about what we can do. For this attempt at removing Amateur Radio privileges, in progress in 2024 and 2025, I do have a platform in Zero Retries, and if I didn't speak out, I'd be complicit in US Amateur Radio's collective apathy about this issue.

You'd be correct to observe that this is seemingly interminable and opaque process by the FCC and commercial interests. But, such process isn't designed to accommodate the amateur (as in non-professional) nature of Amateur Radio. AR is a tiny, bit player in such actions in the 21st century. Such issues are battled out between (very well paid) communications law firms and FCC staff.

But there are openings in the process, and my excessive verbiage below is my attempt to be part of the solution for perhaps preserving US Amateur Radio privileges in the 902-928 MHz band by equipping those who care with needed background information to get involved in this issue.

This article is a consolidation of a number of mentions in Zero Retries of NextNav's proposal to reconfigure the US 902-928 MHz band for their advantage for their (proposed - largely theoretical) proprietary Precision Navigation and Timing (PNT) service.

Apologies that footnote references (with no footnotes) probably crept in below - I couldn't catch them all.

From Zero Retries 0192 2025-03-07:

[\[FCC\] to Explore Alternatives to \[GNSS\] Systems](#)

Reuters:

The U.S. Federal Communications Commission said on Wednesday it plans to vote next month to explore alternatives to GPS after national security concerns have been raised about relying on a single system crucial to modern life.

...

"Continuing to rely so heavily on one system leaves us exposed," FCC Chair Brendan Carr said. "We need to develop redundant technologies."

There have been [reports](#) of a rise in GPS interference around the world, particularly since 2023, known as spoofing raising fears of an increased risk of accidents if planes veer off-course.

"Disruptions to GPS have the potential to undermine the nation's economic and national security. And the risks to our current system are only increasing," Carr said, noting President Donald Trump and a bipartisan group of lawmakers have called for action for years.

In my **Request to Send** editorial in **Zero Retries 0177** (2024-11-08), I pretty much predicted this development. With this receptivity from the FCC, NextNav will undoubtedly *double down* with their proposal for a radical reconfiguration of the US 902-928 MHz band to compress / restrict secondary and unlicensed users of that band, *including US Amateur Radio*, into a small portion of the band.

The next few years will be as opportune a moment as NextNav will ever get to press their case for their proprietary technology, their (paid only) Precision Navigation and Timing (PNT) services, and their (allegedly required) reconfiguration of 902-928 MHz. So... US Amateur Radio, *brace for potential impact*.

Update - All previous mentions of this topic are reprinted below.

...

While the US Department of Defense Global Positioning System (GPS) is not the only Global Navigation Satellite System (GNSS)³ in use... it is the only

one *directly under the control and influence of the US government*. The most notable GNSS system other than GPS is the European Union's [Galileo](#) system, and all modern GNSS receivers also receive (and interpolate) GNSS signals from both GPS and Galileo. We used to have alternative positioning and timing reference systems - LORAN, WWV and WWVH, etc.

Related - Stuff You Should Know podcast - [How GPS Works](#). The hosts are a little fuzzy on the basics⁴, including that by design, GNSS receivers are *entirely passive*, but overall it's an interesting 48 minutes of listening.

Related (but confused) - [Planes are having their GPS hacked. Could new clocks keep them safe?](#) This article discussed new developments in precision timebases that can replace the choice to use GNSS signals as a (cheap) source of precision time reference. But they don't point out that GNSS signals isn't the only, or even the best source of precision time reference... the only reason to use GNSS signals is that they work, and GNSS receivers are cheaper than standalone precision time references.

But merely having an independent precision timebase doesn't negate the need for *position reference* provided by GNSS signals. But fortunately, there are a number of advancements in Inertial Navigation Systems, which would negate the need for (external) GNSS signals.

For large systems like aircraft, ships, and military vehicles, reliance on GNSS systems for position data isn't a requirement - *it's merely a cost effective choice*.

#

From *Zero Retries 0164*, 2024-08-09:

FCC Public Notice - Wireless Telecommunications Bureau and Office of Engineering and Technology Seek Comment on NextNav Petition For Rulemaking

NextNav Inc. (NextNav) filed a petition for rulemaking requesting that the Commission initiate a proceeding to reconfigure the 902-928 MHz band (Lower 900 MHz Band) and adopt new rules to enable the deployment of a 5G terrestrial positioning, navigation, and timing (PNT) network that "complements and backs up" the U.S. Global Positioning System (GPS). By this Public Notice, the Wireless Telecommunications Bureau (WTB) and the Office of Engineering and Technology (OET) jointly seek comment on NextNav's Petition.

...

Amateur radio operations are allocated on a secondary basis to LMS. Part 15 unlicensed devices also operate in the band, are not typically afforded interference protection, and may not cause harmful interference to LMS licensees, amateur operations, or other licensed systems. However, Commission rules intended to ensure coexistence between services require M-LMS licensees to demonstrate through field tests that their systems do not cause unacceptable levels of interference to part 15 devices.

This goes on for 8 pages of dense, tortured, legalistic, pseudo-technical explanations from NextNav of how *this* system is *desperately* needed and is *the* solution for "3D positioning accuracy".

This is NextNav's second attempt at getting the FCC to reconfigure 902-928 MHz to accommodate their technology. Their previous attempt was [dismissed by the FCC in 2014](#):

By this Order, we terminate the above-captioned Multilateration Location and Monitoring Service (M-LMS) rulemaking proceeding, and conclude that the various proposals for broad revisions of the applicable rules do not merit further consideration at this time.

It's particularly galling that "LMS" licenses were auctioned in 2005, but the buyers of those licenses simply could not make their technology work to actually deploy a working system in accordance with their licenses and *the unique situation and user hierarchies inherent in 902-928 MHz when they bought those licenses!*

Originally this system was posited as the solution to more precise automatic location during E911 calls. GPS receivers built into mobile phones, and other measures such as triangulation from cell towers has proven to be an adequate solution for that issue. Thus, NextNav has pivoted its technology's purpose to "backing up GPS". The history of Location and Monitoring Service (LMS) in 902-928 MHz has gone on [for nearly two decades now](#) trying to exploit an LMS license in this band for monetary gain (likely hoping for a buyout of their license) or a favorable "spectrum swap". In those nearly two decades, 902-928 MHz has become used for millions of devices (I'd argue *hundreds* of millions of devices) such as Automatic (radio) Meter Reading (AMR). Usage of unlicensed devices in 902-928 MHz has literally exploded beyond any possible accounting by FCC or anyone else, and is poised to increase even more with inexpensive and capable 802.11ah / Wi-Fi HaLow devices that have recently emerged as a solution for wider range personal wireless networks that can extend up to several miles, including through trees.

My previous house in Woodinville, Washington had *three* such devices operating in 902-928 MHz - one on the water meter, one on the electric power meter, and another on the natural gas meter, all using a common radio network.

But, however... nonsensical and blatantly self-serving in trying to posit a "crisis" as this Petition for Rulemaking is, *it is a formal proceeding underway by the FCC*. If granted, it definitely will affect Amateur Radio's use of 902-928 MHz, such as the new capabilities we could soon be using with 802.11ah / Wi-Fi HaLow devices.

Comments Due: September 5, 2024

Reply Comments Due: September 20, 2024

Sigh... great... *more* pro forma, legalistic writing of a formal comment to the FCC, with a tight deadline.

My thanks to Zero Retries Pseudostaffer Orv Beach W6BI for mentioning this document to me.

#

From *Zero Retries 0165*, 2024-08-09:

ARRL and Meshtastic Publicize the Fight to Save 902-928 MHz

[ARRL Urges Protecting the Amateur Radio 902-928 MHz Band](#)

The Federal Communications Commission (FCC) accepted for public comment a [Petition for Rulemaking filed by NextNav Inc.](#), a licensee in the 900-MHz Location and Monitoring Service (LMS), to completely reconfigure the 902-928 MHz band and replace the LMS with high-powered 5G cellular and related location services.

...

ARRL is preparing comments urging protection of existing and future amateur uses in this band. ARRL urges all amateurs to study the proposal and file their own comments describing their activities in this band and the expected effect of the proposed changes. The filing deadline is September 5, 2024. Replies to comments are due by September 20, 2024. [Click here for a guide to filing comments.](#)

[Meshtastic's Opposition to Proposed Changes on 900 MHz Band](#)

The Federal Communications Commission (FCC) is currently considering a proposal from NextNav that could drastically reshape the 900 MHz band. While this proposal may seem like just another routine reconfiguration, it has significant implications for a broad range of users, particularly those who rely on unlicensed spectrum for innovative, community-driven projects. At the heart of the debate lies the potential impact on open-source initiatives like Meshtastic, an open-source, decentralized communication platform that operates in the 900 MHz ISM band.

As a community, we are raising our voices in opposition to this proposal, and here's why we believe it's crucial for all stakeholders, especially amateur radio operators, tech enthusiasts, and public safety advocates, to understand the ramifications of this change.

Understanding the 900 MHz Band and Its Importance

The 900 MHz band is a critical piece of spectrum used for various applications, including industrial, scientific, and medical (ISM) purposes, as well as amateur radio. It's a unique band that supports a wide array of technologies, from garage door openers and baby monitors to more advanced uses like Meshtastic's decentralized communication networks.

Meshtastic leverages LoRa (Long Range) technology to facilitate long-distance communication without relying on centralized infrastructure. This capability is especially valuable in remote areas where traditional communication networks are either unavailable or unreliable. The proposal by NextNav threatens to disrupt this delicate balance by reallocating portions of the 900 MHz band, which could severely impact these unlicensed applications.

...

These two organizations representing non-commercial user communities are only the leading edge of what will likely be a *tsunami* of opposition to [NextNav's petition](#) at the FCC, and the [FCC's Request for Comments - Docket 24-240](#). There are *entire industries* that have been built on using 902-928 MHz without the requirement of a license, and they're "getting along" with the many competing users in 902-928 MHz... unlike NextNav. One prominent company that will almost certainly file comments is Amazon, which builds a neighborhood area network into their home devices, operating on 902-928 MHz (in the USA) called [Amazon Sidewalk](#).

One primary argument I will be making is that NextNav *knew the mixed environment and unusual rules* when they bought their licenses in 902-928 MHz... and now want to change those rules.

There are already [150+ comments on Docket 24-240](#). There will be hundreds more, perhaps thousands in the next few weeks. But there's a tight deadline:

- Comment Period End Date: Sep 05, 2024
- Reply to Comment Period End Date: Sep 20, 2024

~~I have started a small, private email list for those who are involved in Amateur Radio (including manufacturers, etc.) or closely related such as Meshtastic so that we can "cross fertilize" our comments to make the strongest case possible in opposition to NextNav with the FCC. Email me if you'd like to participate on that email list.~~

Update - There was very little interest in the email list, so there was little point in continuing it.

###

From *Zero Retries* 0167 2024-08-30:

FCC Docket 24-240 Deadline for Comments is *Thursday 2024-09-05*

As I finish editing this issue of Zero Retries, there are now [307 comments filed in FCC Docket 24-240](#), NextNav's attempted hostile takeover of the US 902-928 MHz band.

As of this issue of Zero Retries, I have not yet completed my study of all of the comments filed to date, nor have I completed my comments on this issue. To give Zero Retries readers a chance to read my comments on FCC Docket 24-240 and formulate their own comments, I'm planning to publish Zero Retries 0168 as a special issue devoted to addressing FCC Docket 24-240 on **Tuesday 2024-09-03**.

Not only is NextNav's attempted hostile takeover of the US 902-928 MHz band an existential issue for Amateur Radio's continued (and projected, especially *data*) use of the 902-928 MHz band, it's an existential issue for continued use of that band for many other user communities that have evolved in the past two decades, including self-education of the "Spectrum Workforce" and STEM education in radio technology.

It's going to be a long weekend... but hopefully the intense sprint will relax after Zero Retries 0168. Then...

###

From *Zero Retries* 0168 2024-09-04:

Backgrounder on Commenting on FCC Docket 24-240

By Steve Stroh N8GNJ

My backgrounder to Zero Retries readers, and my comments to the FCC regarding FCC Docket 24-240, NextNav's attempted reconfiguration (hostile takeover) of the 902-928 MHz band in the US, due by end of day 2024-09-05.

Please understand that what follows is my personal perspective on how best to offer comments to the FCC on Docket 24-240. I'd like to think my comments are "informed", but in the end they are my comments from my background and my perspective.

If you offer your comments to the FCC based on what you read here, please don't accept what I say "blindly". If you read my points, and agree, great. But please don't consider me and my comments an all authoritative source.

Primary things to know about FCC Docket 24-240

- [FCC WTB and OET Seek Comment on NextNav Petition for Rulemaking](#) (PDF)
- [ARRL Guide to Filing Comments with FCC](#) (how to use the FCC's Electronic Comment Filing System (ECFS)).
- The FCC ECFS allows either "fill or paste comments into a text box" or attachment of a document file. If you intend to attach a document file, please consider the following from someone who spent several days reading Comments submitted to Docket 24-240. I recommend:
 - Convert your document file to a PDF, and submit the PDF file. While the ECFS does allow the file format to be a .txt, a .rtf, a .doc, or a .docx, those types of files cause a "helper app" to be loaded, and (at least, in my opinion), *that's a pain*. Microsoft Word as a "reader" was such a pain I disabled it on my system. In contrast, a PDF file opens right in the web browser and is formatted exactly as the author laid it out.
 - From experience, when I use web addresses in a filing to the FCC, I don't attempt to do hyperlinks. Instead I follow the word(s) that would be hyperlinked with the URL in parentheses such as (https://hyper.link). I've seen FCC submissions where the hyperlinks were converted and mangled to the point where the hyperlinks were rendered unusable.
 - I know that legal documents use footnotes (and the FCC uses them extravagantly). But like hyperlinks, I've seen submissions to the FCC where the footnotes were mangled (often cut off) and thus rendered unusable. Thus I don't incorporate footnotes in my FCC submissions. (Yes, this issue of Zero Retries includes footnotes, but when I convert my comments for submission, there won't be any footnotes.)
 - Include your name and the docket number in the filename, such as: FCC_24-240_Comments_of_Steven_K_Stroh. With that, the bare minimum of information about your input is discernible when downloaded into a directory of other such files.
 - This next is a very personal preference from dealing with files accessed from mixed operating systems such as UNIX and Linux and MS-DOS3 that "barf" on filenames with spaces and characters other than dashes (-) and underscores (_). I generally create filenames as a string, using only dashes and underscores as separators. For my personal use, I only use lowercase characters, but that's often annoying to those less geeky than I, so for "polite company" like this, I use mixed case in a filename.
- The close of the Comment period is end of day Thursday 2024-09-05 - **tomorrow**! If it's not possible to submit your comments by then, submit them anyway, as soon as possible (it cannot hurt). The FCC will eventually close Comment submission.
- Following the Comment period, there is a Reply to Comment period which ends 2024-09-20.
- Here is the listing (search) of [Comments on Docket 24-240 filed to date](#) (more than 400)
- Previously coverage of FCC Docket 24-240 in Zero Retries:
 - **Zero Retries 0165** - ARRL and Meshtastic Publicize the Fight to Save 902-928 MHz
 - **Zero Retries 0167** - FCC Docket 24-240 Deadline for Comments is Thursday 2024-09-05

In my (very incomplete) reading of comments, the three main types of responders are industry / government users such as Radio Frequency Identification (RFID) and Internet of Things (IOT), Meshtastic users, and Amateur Radio Operators.

What the FCC Wants to Hear About (Cares About)

A trusted advisor provided me with this short, pithy, realistic, and a bit brutal "reality check" list of the real priorities of the FCC in considering issues such as Docket 24-240:

- Innovation
- Creating new tax paying businesses
- Unserved and underserved populations
 - Native Americans
 - People with disabilities
 - Schoolchildren
- Emergency communications
- Broadband communications

- Revenue to the US government (spectrum auctions)
- Cellular Telecommunications & Internet Association (CTIA)⁴
- National Association of Broadcasters (NAB)⁵

This adviser consistently offers “distilled wisdom” on matters relating to the FCC, and I am very grateful for his input such as this.

To this adviser’s points, I would add:

- Addressing the shortage of the Spectrum Workforce as outlined in the Biden-Harris Administration’s National Spectrum Strategy (<https://www.ntia.gov/issues/national-spectrum-strategy>) to expand the workforce of those knowledgeable about radio technology to create new radio technology systems and build and maintain radio technology systems.
- STEM education (we need more techies, not just programmers)
- US national and regional security, including (radio systems) cybersecurity
- US national economic activity / impact (not necessarily just paying taxes)

Note that “hobbyist” activity such as “playing around with Meshtastic” or “chatting on an Amateur Radio repeater” does not appear on the above list. Such activities are simply not on the FCC’s “cares about” list. But using Meshtastic to encourage STEM and Maker activities by students and youth, or Amateur Radio repeaters to provide emergency and “no dependence on cellular, Internet, or satellite” communications is something that the FCC “cares about”.

Attacking NextNav Won’t Make an Impact With the FCC

Expressing one’s opinions about NextNav’s business model, technology, motivations, or its assertions about its importance to the overall security of the US as “backup” for GPS will not make an impact with the FCC, in my opinion. For example, claiming that that NextNav’s actions “aren’t fair” will have no impact with the FCC.

It’s settled precedent that NextNav obtained a license for its services from the FCC to operate in 902-928 MHz. What’s at issue is NextNav’s claims that its proposed reconfiguration of 902-928 MHz into dedicated sub-bands for its operations “minimally impacts” other uses of 902-928 MHz, and that the current rules on “interference” should be altered to favor NextNav’s (proposed) operations.

However specious and self-serving NextNav’s claims seem (their “create more 5G spectrum” is particularly galling to me), offering comments that are essentially “emotional” attacks on NextNav’s claims simply won’t make any impact with the FCC.

In short, for maximum impact with the FCC, comments against NextNav’s proposed changes to 902-928 MHz need to be made on standing, facts, merit, technical aspects, and especially the “FCC cares about...” points.

“Standing” is that as an Amateur Radio Operator, I am qualified to comment on how NextNav’s proposed changes will impact Amateur Radio Operations on 902-928 MHz. But I also have standing, as a citizen user of 902-928 MHz, to comment. Admittedly it’s a bit tricky to offer “citizen” comments that aren’t “hobbyist”, but I think it’s possible.

Mostly it’s important to remember that Amateur Radio operations in 902-928 MHz are secondary to NextNav’s operations in 902-928 MHz. Not only are Amateur Radio operations in 902-928 MHz secondary to NextNav, they are tertiary to other operations such as industrial use, US military RADAR, as well as Location and Monitoring Services (LMS) which is the type of service that NextNav offers in 902-928 MHz. Amateur Radio is not the “big dog” in 902-928 MHz.

##

From *Zero Retries* 0168 2024-09-04:

Comments of Steven K. Stroh Regarding FCC Docket 24-240

Submitted 2024-09-05 via the FCC Electronic Comments Filing System as a PDF file, filename FCC_24-240_Comments_Steven_K_Stroh_2024-09-05.

Abstract

I feel that the radical reconfiguration of 902-928 MHz proposed by NextNav in Docket 24-240 is not in the broadest possible public interest. 902-928 MHz is a unique portion of spectrum, with an enormous number of users and systems, using widely varying technologies and techniques to coexist and cooperate in 902-928 MHz. In short 902-928 MHz is a unique ecosystem for radio technology in the US, and its current configuration should be continued. I will cite a number of technologies which provide equivalent services and capabilities to those that NextNav states can only be provided by its proprietary technology and by radical reconfiguration and disruption of 902-928 MHz.

Background

I am an Amateur Radio Operator (callsign N8GNJ), licensed for nearly 40 years. I am a GMRS user (callsign WRPS598). I also had a Citizens Band license - callsign xxxxxxxx. My professional background is an Electronic Technician, computing System Administrator, and Technology Writer. I live in Bellingham, Washington. I write a weekly independent newsletter called Zero Retries (www.zeroretires.org) that highlights technological innovation occurring in Amateur Radio worldwide.

My primary interest within Amateur Radio is operating data communications modes, experimentation, and helping to develop and prove new radio-based data communications modes. In Zero Retries every week, I document the remarkable evolution in radio technology occurring in Amateur Radio based on new technologies such as Software Defined Radio (software and hardware), Digital Signal Processing, novel and new antenna techniques, use of multiple inexpensive receivers and many other fascinating new approaches and technologies applied to old problems in radio communications.

In short, I posit to the readers of Zero Retries that Amateur Radio is a literal license to experiment with radio technology, with low barriers to entry, especially in the Amateur Radio VHF / UHF bands of which 902-928 MHz is one.

While my primary standing to comment on Docket 24-240 is my perspective as an Amateur Radio Operator, I also feel qualified to comment on Docket 24-240 as a member of the general public (a citizen) who uses 902-928 MHz for experimental and education purposes, as well as mundane uses of 902-928 MHz such as a cordless telephone that was specifically chosen for its operation on 902-928 MHz to not be interfered by my wireless systems operating on 2.4 GHz.

Comments on Amateur Radio Usage of 902-928 MHz

Amateur Radio operations readily acknowledge their place in the hierarchy of operations within 902-928 MHz and has figured out how to “fit in”, typically by placing its systems and operations at the lower and upper ends of the band where the “noise” from unlicensed systems is lowest.

In some parts of the US, use of portions, or all, of the (shared) “Amateur Radio” 420-450 MHz band is prohibited due to the primary user of this band - operation of the US military’s PAVE PAWS RADAR systems.

Another band where Amateur Radio operations seem likely to be severely restricted is the 1240-1300 MHz band where the primary user is Global Navigation Satellite Systems (GNSS) which have begun coming online in the past several years, primarily Europe’s Galileo system.

Thus, many US Amateur Radio operators, clubs, and systems such as repeaters, have begun using 902-928 MHz - quite successfully (and uneventfully to other uses and users of 902-928 MHz).

Many Amateur Radio commenters have described the technical issues of radio systems used for Amateur Radio in 902-928 MHz as to why it is infeasible to reconfigure them to accommodate NextNav’s suggested reconfiguration of the band.

Thus, in many areas where 420-450 MHz is unavailable for Amateur Radio use, Amateur Radio’s ability to provide emergency communications, with no dependence on communications infrastructure such as cellular networks, Internet, or satellite, would be reduced or curtailed if NextNav’s suggested reconfiguration of 902-928 MHz were implemented.

If NextNav’s suggested reconfiguration of the band is implemented, Amateur Radio’s ability to provide emergency communications using 902-928 MHz would be severely reduced or curtailed. Thus, that impact on emergency communications capability should be a consideration by the Commission.

If 902-928 MHz Is Reconfigured Per NextNav’s Request, a Unique Spectrum Ecosystem Will Be Severely Impacted

902-928 MHz is a spectrum resource that is unique to the Americas (ITU Region 2), and especially to the US and Canada. 902-928 MHz is uniquely useful because its characteristics are somewhat like the UHF bands:

- Good penetration of trees
- Radios for 902-928 MHz are easier to build compared to microwave frequencies

But also similar to the microwave bands above 1 GHz:

- Antennas are small and manageable
- Antennas can be made directional, but still compact, for longer range using minimal power

Because of those aspects of 902-928 MHz, it has become the “go to” band for experimentation, innovation, and deployed services and systems. Varying uses of 902-928 MHz range from cordless telephones, to Amazon’s Sidewalk Network for its smart home devices, to Amateur Radio using 902-928 MHz for Earth-Moon-Earth communications experimentation.

Another example of the utility of 902-928 MHz comes from my earlier career of writing about Wireless Internet Service Providers (WISPs). 902-928 MHz was the first band where Internet Access via wireless systems was possible. I wrote about the use of an innovative small company, WiLAN offering its “Hopper” products to some of the earliest WISPs which were then able to provide Internet service in rural areas that barely had landline telephones. Metricom, using 902-928 MHz for its Ricochet service, proved out the utility of microcells on utility poles, far predating the use of microcells by the cellular industry.

While 902-928 MHz use by WISPs have declined because other bands offered higher speeds, 902-928 MHz is still in use by many WISPs in places where its unique characteristics are useful, such as areas with extensive tree cover.

Those are just a few examples from my personal experience, amongst hundreds, perhaps thousands of use cases, technologies, and operating systems and services where the unique characteristics of 902-928 MHz and the Commission’s decision to allow Licensed by Rule operations in that band have made it the preferred spectrum choice. In 902-928 MHz, the Commission has created a portion of spectrum where innovative radio technology techniques and systems can be developed, tested, and deployed rapidly and at minimal cost (no leasing or licensing of spectrum required).

From my perspective, the most impressive aspect about 902-928 MHz is that all these myriad use cases have all figured out how to “get along”. 902-928 MHz is a spectrum “melting pot” or “mixed, eclectic neighborhood” where every use and user of 902-928 MHz has figured out how to fit in and get along with all the other uses and users.

And that innovation in 902-928 MHz continues to the present day and the projected future.

One of the biggest changes in 902-928 MHz in recent years is the creation of LoRa (<https://www.semtech.com/lora>) which is an implementation of Chirp Spread Spectrum modulation. LoRa has proven to be amazingly effective, reliable, and inexpensive. While LoRa was intended as an Internet of Things technology, it has been widely adopted by experimenters who have used LoRa units to create Meshtastic (<https://meshtastic.org/>), an innovative text messaging system using mesh network technology, which has no dependence on cellular, Internet, or satellite infrastructure.

Meshtastic was not created by a company, or a government program. It was created by a user community as an open source project. Meshtastic has been very widely adopted by techies, and is simple enough to build and operate user equipment and network units (relays) that non-techies can also use Meshtastic effectively. Meshtastic has kindled the curiosity and imagination of those who have been curious about radio technology (but not quite ready to

become an Amateur Radio Operator). Such experimentation and self-education should be encouraged (see Spectrum Workforce later in this Comment). We don't yet know the kind of innovation that Meshtastic (and follow-on systems) can create, so we need to allow it to continue.

Several years ago, IEEE ratified a new wireless standard - 802.11ah (https://en.wikipedia.org/wiki/IEEE_802.11ah) for "extended range" networking below 1 GHz, such as 902-928 MHz in the US. In conjunction with 802.11ah, the Wi-Fi Alliance created Wi-Fi HaLow (<https://www.wi-fi.org/discover-wi-fi/wi-fi-certified-halow>). This degree of standardization, coupled with the unique characteristics of 902-928 MHz, incentivized radio chip manufacturers to create inexpensive devices based on these standards. Such devices have only begun to enter the US market in the past year. 802.11ah / HaLow devices show even more promise for innovation, public utility, and economic activity than LoRa because they operate at "broadband" speeds, whereas LoRa devices operate at "narrowband" speeds (by design, given its intended use as telemetry and control for "Internet of Things" applications).

Just one example of innovation and new economic activity is Teledatics (<https://teledatics.io/>), a new US-based manufacturer of 802.11ah / HaLow devices. Companies such as Teledatics were founded and have a market only because of the unique characteristics of 902-928 MHz as they are now. They can compete, cooperate, and coexist with other users of 902-928 MHz... but could not in the "NextNav" version of 902-928 MHz.

902-928 MHz Fills the Role of a De Facto Citizen's Data Radio Service

Over the decades, the Commission has created a number of "citizen" radio services to suit a range of intended uses:

- Citizens Band (CB)
- Family Radio Service (FRS)
- General Mobile Radio Service (GMRS)
- Multi Use Radio Service (MURS)
- The majority of the Marine VHF channels can be used for casual conversation

None of these services require technical examinations, and only GMRS requires a pro forma license from the Commission.

Thus the Commission has clearly recognized the need and utility for radio services that facilitate decentralized (no infrastructure) communications by self-selected groups to talk to one another. But other than a few of the MURS channels, there is no "citizen" radio service where data (other than very short bursts) is specifically permitted.

In this Internet / mobile phone / satellite communications era, where being continuously connected is now expected (and some consider, required), a perceived need for a "Citizen Data Radio Service" has emerged. 902-928 MHz has de facto filled that role through the use of consumer friendly data communications systems such as Meshtastic and 802.11ah / HaLow.

The emergence of Meshtastic has created amazing new independent radio-based text messaging networks in special interest groups (communities of thought) such as:

- Young women interested in tech, using a "techie" way to communicate amongst themselves.
- Casual gatherings of those living full time in recreational vehicles such as the Rubber Tramp Rendezvous in Quartzsite, Arizona.
- Students involved in STEM and Maker activities in small towns
- Children in dense inner city neighborhoods whose parents can only afford prepaid cellular Internet... but Meshtastic equipment is cheap and free and unlimited to use.
- Families and students living on native reservations where connectivity is expensive and unreliable.
- "Flotillas" of boaters anchoring down in a cove (boating equivalent of the RV example).

Meshtastic networks have become so commonplace and empowering to various communities that Iffy Books, a bookstore in Philadelphia, offers classes on how to use Meshtastic and build Meshtastic networks (<https://iffybooks.net/event/meshtastic-101-class-aug-23/>).

I posit that there has been amazing amounts of innovation and economic activity resulting from the creation, use, and network deployment of Meshtastic by thousands of individuals. Hundreds, perhaps thousands of new decentralized "no infrastructure" networks have been created for text messaging by leveraging low cost, low power devices, open source software, mesh networking techniques, all operating in 902-928 MHz. Contrast this with the very limited impact of the very expensive, proprietary, high power, licensed, centralized, corporate NextNav technology and systems, that NextNet claims can only be operated reasonably by reconfiguring 902-928 MHz per NextNet's requirements.

Thus if NextNav's suggested reconfiguration of the band is implemented, this de facto "Citizens Data Radio Service" role of 902-928 MHz would be severely reduced or curtailed as LoRa and 802.11ah / HaLow were designed to operate in 902-928 MHz as it is currently configured. Thus, the emerging use of LoRa / Meshtastic and 802.11ah / HaLow for providing ad-hoc communications, including emergency communications, by individuals and small groups, should be a consideration by the Commission.

The Subtle Role of 902-928 MHz in Addressing the "Spectrum Workforce" Shortage

As an agency of the US government, the FCC is well aware of the Spectrum Workforce shortage as documented in "Pillar Four" of the Biden Harris Administration's National Spectrum Strategy (<https://www.ntia.gov/issues/national-spectrum-strategy>). The Biden Harris Administration considers expanding the workforce of those *deeply* knowledgeable about radio technology as crucial to US security and international competitiveness in technology. Such an expanded "Spectrum Workforce" is needed for the US to be able to "take full control" of the radio technologies used by citizens, industry, government, and military. Currently, as with semiconductor manufacturing, the US is vulnerable that much of the radio technology it uses is created and manufactured by other countries that may render the US vulnerable if such technology is withheld or tampered with.

While 902-928 MHz may not seem relevant to the Spectrum Workforce shortage, I posit that it is indeed relevant because Science, Technology, Engineering, and Math (STEM) programs and hardware (used by "Makers") make use of radio technology, and increasingly that hardware uses LoRa and

other radio technologies that operate on 902-928 MHz. STEM and Maker activities that involve radio communications, such as robots, airborne drones, and instructive projects such as monitoring a favorite plant's soil moisture via radio, usually use 902-928 MHz. That band offers range, higher reliability than the very heavily used 2.4 GHz / 5.x GHz bands, and choice of a number of radio technologies ranging from frequency hopping, to narrowband, even to (wideband) digital video. As an example of how widely used 902-928 MHz is used in STEM and Maker activities, a quick search of Adafruit (<https://www.adafruit.com>), a popular supplier of STEM and Maker electronic modules, shows 21 matches for "915 MHz", and 54 pages in a search for "LoRa".

I posit that being able to teach the use of radio technology in STEM / Maker activities is as critical as teaching basic electronics, programming, and physical construction (such as 3D printing). If a student is taught to "assume that a radio link will always work", when it inevitably does not work due to interference, electronic failure, or even a cyberattack (taking control of the radio link), the result is situations such as vehicles being easily stolen because poor security practices were used in designing the vehicle's "wireless key fob". Using radio technology such as 902-928 MHz in STEM and Maker activities teaches students to understand radio technology at low level, and puts them on a path to potentially be part of the future Spectrum Workforce.

Is NextNav's Proprietary Technology Worth "Sacrificing" the Flourishing Spectrum Ecosystem of 902-928 MHz?

In this section, I do not intend to "challenge" NextNav's technology assertions. But I do wish to offer some "bigger picture" perspective to some of NextNav's claims that only their proprietary technology can be a backup in the US for navigation and timing services provided by GNSS systems.

PNT Services

In the past two decades since NextNav obtained its licenses and began operations in 902-928 MHz, other approaches to offer Positioning, Navigation, and Timing (PNT) services, independent of GNSS services, have emerged that do not require the use of 902-928 MHz, and especially do not require the reconfiguration of the 902-928 MHz band per NextNav's request.

Broadcast Positioning Service - BPS

One of the most promising such systems that can back up GNSS in urban areas and could quickly become ubiquitous is the Broadcast Positioning System (BPS) (<https://www.gps.gov/governance/advisory/meetings/2022-11/matheny-mondal.pdf>) that is a subsystem of over the air television transmissions that have been upgraded to the ATSC 3.0 (Next Gen TV) standard.

eLORAN

For wide area backup of GNSS, such as use on marine vessels, is Enhanced Long Range Aid to Navigation - eLORAN (<https://gps.stanford.edu/research/early-gpsnt-research/enhanced-long-range-navigation-eloran>). As with all technologies, especially radio technologies, capabilities have vastly increased, and costs have exponentially decreased, and LORAN technology and now eLORAN technology is no exception. If the US is serious about the requirement of a backup system for wide area positioning and navigation, LORAN and eLORAN technology is proven.

Inertial Navigation Systems - INS

For mobile platforms that require precise navigation, but must be able to navigate without relying on GNSS, technology has advanced to create cost-effective Inertial Navigation Systems (INS) (<https://www.advancednavigation.com/tech-articles/the-critical-role-of-inertial-navigation-in-armored-combat-vehicles-ensuring-precision-in-gnss-denied-environments>).

Rubidium Atomic Timebases

For providing precision timekeeping, as with all technology, the state of the art and functionality of standalone precision timebases has become much more affordable than they were two decades ago. A rubidium atomic timebase system such as required for radio system network coordination (<https://www.thinksrs.com/products/sr625.html>) is now available for \$7,000. Such a unit was many times that cost two decades ago, which drove the use of GPS receivers to be used as inexpensive precision timebase systems.

"5G" Spectrum

The Commission has made huge amounts of "5G" spectrum available in the past two decades, calling into question that NextNav's assertion that its requested reconfiguration of 902-928 MHz provides needed "5G" spectrum.

CBRS - 150 MHz of "5G" Spectrum

In the last decade, the Commission created a sharing system that made 150 MHz of "5G" spectrum - 3.55 - 3.70 GHz, the Citizens Broadband Radio Service (CBRS) available. Not only was CBRS an innovative way to allocate "new" spectrum, this spectrum can be used not just by cellular carriers but also enterprises, and very small entities such as individual commercial buildings, college campuses, and small businesses.

Wi-Fi 6E (6 GHz) - More Than 1 GHz of "5G" Spectrum

In the most notable allocation of spectrum of late, the Commission allocated more than 1 GHz of spectrum at 6 GHz for license by rule use, most widely known as Wi-Fi 6E. With the this much spectrum being made available, cellular carriers are able to "offload" some of their customer's activity onto 6 GHz, such as picocells and microcells, freeing up localized usage of their "wide area" spectrum.

Galileo - Robust GNSS Services

NextNav makes the claim that GNSS signals can be easily disrupted or "spoofed". But newer GNSS technology has advanced to provide GNSS capabilities that are far more resistant to jamming than GPS. Europe's new Galileo GNSS system cryptographically "signs" its transmissions, thus simple spoofing can be detected and ignored (<https://www.septentrio.com/en/learn-more/insights/osnma-latest-gnss-anti-spoofing-security>).

In Conclusion

In Docket 24-240, NextNav has proposed a radical reconfiguration of the 902-928 MHz band. If adopted, NextNav's reconfiguration will be highly disruptive, and in many cases destructive (no practical or cost effective way to adapt to the reconfiguration) to hundreds of systems and likely tens, or possibly hundreds of millions of individual units that use 902-928 MHz daily.

It's not hyperbole to project that entire companies that manufacture units that operate in 902-928 MHz or operate systems in 902-928 MHz will simply go out of business from the immense costs of having to reconfigure their units or systems.

Just to cite one example of 902-928 MHz usage, many (most?) utility systems use Automatic Meter Reading (AMR) transmitters operating in 902-928 MHz. My former home in suburban Seattle had three such transmitters - one each for the water meter, the natural gas meter, and one for the electricity meter. And every thousand feet or so on a utility pole was an AMR "repeater" unit to receive the transmissions from the meters. All of those AMR transmitters, and entire networks of "repeater" units would need to be manually replaced - hugely disruptive, and hugely expensive, with the cost ultimately being borne by utility customers... unless NextNav proposes to pay for those equipment replacement costs.

Amateur Radio's role in providing emergency communications services with repeaters operating in 902-928 MHz would be effectively shut down as there's no affordable method available to change Amateur Radio operations to accommodate NextNav's proposed reconfiguration of 902-928 MHz... unless NextNav proposes to pay to create a new class of Amateur Radio repeaters and user radios to conform to its proposed reconfiguration of 902-928 MHz.

The use of 902-928 MHz as a de facto "Citizens Data Radio Service" would be severely impacted. All new LoRa and 802.11ah / HaLow units would have to developed to conform to NextNav's proposed reconfiguration of 902-928 MHz. While the cost of the individual units is low, and it's feasible to "simply buy a new "conforms with NextNav" unit, the development costs for new LoRa and new 802.11ah / HaLow systems would be huge, and many small companies such as Teledatics would probably be forced out of business by such development costs... unless NextNav proposes to reimburse Teledatics and many other companies for the costs to redesign their systems to NextNav's configuration of 902-928 MHz.

Lastly, in the "Is NextNav's Proprietary Technology Worth "Sacrificing" the Flourishing Spectrum Ecosystem of 902-928 MHz?" section, while NextNav legitimately posits that there are a number of issues resulting from over dependence on the US GPS system, such as location, navigation, and precision time services...

I briefly mentioned a number of other solutions for those issue that seem equally as viable as NextNav's proprietary technology which would requires the huge disruption of current configuration, users, and usage of 902-928 MHz.

Managing the Radio Spectrum for the Broadest Possible Public Interest

In the most broad perspective of the Commission's "mission", it is to manage the portion of the electromagnetic spectrum that is "usable for radio communications" to the highest and best use for the broadest possible public interest. The Titanic sinking, and rescue, in 1912 was the first major critical use of radio communications technology. The aftermath of the Titanic sinking required new management of radio spectrum to make ship communications reliable. That management required making some hard decisions about "highest and best use" of competing user communities (such as segmenting radio broadcasting and ship communications into separate portions of the radio spectrum) and choosing between competing technologies to effectively use limited radio spectrum.

In Docket 24-240, the Commission is again tasked with making decisions about "highest and best use" of competing user communities and competing technologies to effectively use the limited radio spectrum of 902-928 MHz.

In the totality of the unique nature of 902-928 MHz, the diverse users and systems that have evolved, and thrived, and profited in 902-928 MHz as it is currently configured, and the availability of systems that can provide effective backup of PNT services provided by GPS in the US...

NextNav's Proposed Reconfiguration of 902-928 MHz is Not In the Broadest Possible Public Interest

I respectfully suggest that NextNet's proposed reconfiguration of 902-928 MHz is simply not in the broadest possible public interest. Thus I recommend that to the Commission that in evaluating Docket 24-240 NextNav's proposed reconfiguration of 902-928 MHz should be denied.

Signed,

Steven K. Stroh

P.O. Box 30725

Bellingham, Washington, USA

###

From Zero Retries 0169 2024-09-13:

Reply Comments on FCC Docket 24-240 Due on Friday 2024-09-20

If you're an Amateur Radio Operator in the US, you should care about [FCC Docket 24-240](#), a plan to radically reconfigure the 902-928 MHz band for the proprietary advantage of one company, and would likely render the band nearly unusable for Amateur Radio and most unlicensed (Part 15) uses.

For background, see Zero Retries 0168 which explained the issues from a Zero Retries perspective.

There are two phases of comments:

- Comments on Docket 24-240 were due by end of day 2024-09-05.
- Reply Comments (essentially, comments on the comments) are due by end of day next Friday 2024-09-20.

As of this writing, 958 comments are on file with the FCC for Docket 24-240.

If you didn't file a Comment, you can still file a Reply Comment. In the FCC's [Electronic Comments Filing System](#), in the TYPE OF FILING, be sure to select REPLY TO COMMENTS (because we're now in the Reply Comments period).

Pro Tip - The definition of "Reply Comment" ~~is pretty loose~~ *there really isn't any*. The intent of the FCC Reply Comment period is, again, comments *on the comments*, and if it came to a really detailed legalistic parsing, anything that isn't a direct comment on a (previously filed) comment wouldn't be relevant to the FCC. But from everything I've been told, "Comments" filed in the "Reply Comments" period are still accepted and considered.

So... just say something. Every little bit helps. Sadly, some large Amateur Radio organizations, and companies, *with paid staff*, didn't file comments.

Hopefully we'll dodge this bullet and 902-928 MHz will be even more usable.

It's my opinion that if Docket 24-240 is declined and the 902-928 MHz band remains configured as it is now, in just a few years, Amateur Radio and unlicensed (Part 15) users will look back and feel that a major bullet was dodged because both Amateur Radio and unlicensed users will be making more and better use of 902-928 MHz than most folks can imagine at the moment.

Why? Because of the standards effect of IEEE 802.11ah and Wi-Fi HaLow which is (finally) a Wireless Local Area Network (WLAN) standard for the unique properties of spectrum (like 902-928 MHz) below 1 GHz. Now that there is both a technical standard and an interoperability standard, lower cost units are emerging, and interoperability can be assumed. That means a mass market - better hardware, lower prices, and rapid evolution due to competitive pressure.

There is precedent to imagine such a scenario. The FCC legalized "communications" use of the Industrial, Scientific, and Medical (ISM) bands like 2.4 GHz in 1985. In the following years, some proprietary Wireless Local Area Network (WLAN) hardware emerged for the ISM bands. But it took the creation of the IEEE 802.11b standard being finalized around 1999 that a mass market for Wireless Local Area Network (WLAN) could emerge with reasonably affordable hardware and reasonably assured interoperability. In the IT industry, standardization matters if you want things to really scale... and we finally have good standards for a mass market for consumer (and experimenters, and Amateur Radio) use of 902-928 MHz for data.

###

From Zero Retries 0170 2024-09-20:

Background on my FCC Docket 24-240 Reply Comments

My apologies for overpromising and underdelivering this week. I intended to publish this issue of Zero Retries earlier than the usual 15:30 Pacific on Friday, but I am actually publishing this issue late on Friday. As you read above, it's been a bit of a week for me.

And, of course, my apologies to Zero Retries readers outside the US, for whom the majority of this issue's content isn't very relevant. Things should be "back to normal" next week... or at least what passes for "normal" here in Zero Retries.

The FCC already has *ample* comments now, from many organizations and individuals with standing, on the specific questions the FCC asked in Docket 24-240, so I didn't feel the need to "sing in that particular chorus".

FCC Comment and Reply Comment periods are rare for any FCC issues that involve Amateur Radio - we're kind of "down in the noise floor" for the FCC's attention. Thus when Amateur Radio does have that rare moment of "attention" from the FCC, I feel we (and I) should make the most of it. Thus I ended up spending a lot more time than I originally intended in crafting my Reply Comments.

I began to write my Reply Comments here in Zero Retries, and I created lots of good discussion points that I had intended to include... and then time drew short. So, what you'll read in the two articles has some overlap, but also a lot of divergence. If I had the time... *if I had made the time*... I would have merged, and condensed, and heavily edited the two "versions" of my thoughts on Docket 24-240.

With time getting short in order to file by end of day 2024-09-20, I decided to direct my FCC Docket 24-240 Reply Comments from a unique perspective in discussing the unappreciated role of the 902-928 MHz band as a "Citizens Data Band" and that it's a low barrier to entry way to learn about and experiment with radio technology. I suspect the FCC Commissioners are going to be surprised that so many individuals care about the 902-928 MHz band and this "Meshtastic" system that they've likely never heard about until receiving comments on Docket 24-240.

###

From Zero Retries 0170 2024-09-20:

Last Possible Moment Reply Comment?

If after reading this issue, and you decide you would have wished to file a Reply Comment on Docket 24-240... *please do so* (in the next few days).

It can't hurt, and every little bit might help, even if the FCC ultimately decides not to "disseminate" (formally consider) late Reply Comments.

FCC Electronic Comments Filing System (ECFS) - [Submit an Express Comment](#)

In the **Proceedings** field, type (slowly) 24-240. The system should find the proceeding - just click on the result.

In the text box, I suggest stating "Reply Comment".

And if you're tempted to use a pseudonym or "Anonymous", I advise not to bother to file comments. If I were the FCC, I would simply discard such comments as not credible, that someone didn't care enough to use their real name.

###

From Zero Retries 0170 2024-09-20:

A Few Good Comments on FCC Docket 24-240

By Steve Stroh N8GNJ

With over ~~1500+~~ ~~1600+~~ 1700+ Comments and Reply Comments and increasing until the end of the Reply Comments period on 2024-09-20, it's become impossible (for me as an individual) to do more than a cursory survey of comments filed with the FCC on Docket 24-240. What follows is a personal perspective based on the comments I was able to review.

After reading hundreds of Comments (and very few Reply Comments), I'm cautiously optimistic that the FCC has received ample substantive comments that will provide it sound reasoning to deny NextNav's request to radically reconfigure the 902-928 MHz band to NextNav's proprietary advantage. NextNav proposes to operate high power transmitters in its new exclusive allocation of 918-928 MHz and *compact all non-NextNav activity into an 11 MHz band - 907-918 MHz.*

Based on the number, and quality of the comments in Docket 24-240, the most provably inaccurate statement in [NextNav's original filing](#) is the statement:

The Lower 900 MHz Band is an ideal candidate for swift FCC action as it is **currently underutilized** due to an outdated band plan and technical and service rules that limit the use of the band for fifth-generation ("5G") technologies.

"Currently underutilized" *only* from the perspective of NextNav's proposed usage of Positioning, Navigation, and Timing (PNT). NextNav attempts to ignore the hundreds of companies, organizations, and user communities, and the hundreds of systems and networks, and billions of devices that are in 24 x 365 use in the 902-928 MHz band.

Analogy - the 2.4 GHz Band is Also "Underutilized"

I offer a brief analogy to NextNav's logic that the 902-928 MHz band is underutilized. The 2.4 GHz band could also be considered underutilized because the lower half of the 2.4 GHz band is allocated to Amateur Radio as primary (or secondary) usage, and the upper half of the 2.4 GHz band is allocated for "mobile broadcasting" (such as a point to point link from a "news" helicopter to a receiver to provide a live video feed) as primary (or secondary) usage. Paying attention to only *those* usages, one could posit that the 2.4 GHz band is "underutilized". But not only is 2.4 GHz used for Amateur Radio and "mobile broadcasting", it's used for wireless networking (Wi-Fi), and even video transmission (wireless cameras). But likely the biggest use, by numbers (*tens, or hundreds, of billions of devices*) of 2.4 GHz is *Bluetooth*, which by NextNav's logic of "utilization", would be completely invisible as a use case for 2.4 GHz.

If the FCC were to reconfigure the 902-928 MHz band per NextNav's request, doing so would irrevocably damage thousands of unlicensed (Part 15) and secondary user groups such as Amateur Radio (Part 97). Not to mention render obsolete *literally* billions (not hyperbole... *billions*) of electronic devices.

I think we "incumbents" of the 902-928 MHz band are lucky that NextNav's attempt on the 902-928 MHz band is, in the end, terribly clumsy, if not desperate, and a transparent "spectrum snatch" or as EFF put it, a "Band Grab".

Electronic Frontier Foundation (EFF) has weighed in with a substantive article - [NextNav's Callous Land-Grab to Privatize 900 MHz:](#)

NextNav's Proposed 'Band-Grab'

NextNav wants the FCC to reconfigure the 902-928 MHz band to grant them exclusive rights to the majority of the spectrum. The country's airwaves are separated into different sections for different devices to communicate, like dedicated lanes on a highway. This proposal would not only give NextNav their own lane, but expanded operating region, increased broadcasting power, and more leeway for radio interference emanating from their portions of the band. All of this points to more power for NextNav at everyone else's expense.

This land-grab is purportedly to implement a Positioning, Navigation and Timing (PNT) network to serve as a US-specific backup of the Global Positioning System (GPS). This plan raises red flags off the bat.

Dropping the "global" from GPS makes it far less useful for any alleged national security purposes, especially as it is likely susceptible to the same jamming and spoofing attacks as GPS.

[NextNav itself](#) admits there is also little commercial demand for PNT. GPS works, is free, and is widely supported by manufacturers. If NextNav has a grand plan to implement a new and improved standard, it was left out of their FCC proposal.

What NextNav did include however is its intent to resell their exclusive bandwidth access to mobile 5G networks. This isn't about national security or innovation; it's about a rent-seeker monopolizing access to a public resource. If NextNav truly believes in their GPS backup vision, they should look to parts of the spectrum already allocated for 5G.

In the end, NextNav was only able to garner perhaps a handful of supportive comments. This was the only supportive comment that *I* saw:

[California Fire Chiefs Association](#)

September 13, 2024

Re: Comment on NextNav Petition for Rulemaking; WTDocketNo.24-420; RM-11989

Dear Ms. Dortch:

First responders depend on accurate information to deliver prompt assistance to building occupants and maintain situational awareness in the process. Firefighters, for example, can face zero-visibility conditions in structure fires from smoke and blackout conditions from electrical outages. Having the support of a terrestrial geolocation system that can accurately identify the location of people inside a building could avoid dangerous and time-consuming searches in the wrong areas and accelerate the delivery of life saving assistance to people who need it.

We have firsthand experience with degradation of GPS due to the "urban canyons" and dense environment we cover, a problem that is ideally resolved by a terrestrial PNT service of this type proposed. Having the z-axis requirement as the Commission does is highly important to our operations, and while the 3-meter requirement is a great step forward, the x/y location from GPS is not sufficient for our operations and is sporadic and inconsistent in our region on a daily basis. The ability to have a consistent x/y signal that most importantly penetrates buildings, which these frequencies will accomplish, is truly a gamechanger for the fire service and one which will save lives, reduce time to victim and gain critical situational awareness of where our fire fighters are during an emergency.

NextNav's approach could improve the availability and accuracy of indoor geolocation. I would like to encourage the Commission to proceed forward on this matter as the potential benefits to Public Safety are important to our agency and stakeholders.

Respectfully
Mark Heine, President
California Fire Chiefs Association

Even with this supportive letter, it seems that Heine or the CFCFA staff relied solely on NextNav's highly optimistic potential capabilities in the formation of Heine's letter. The requirement for "higher precision Z axis positioning" has been known for some time, and the US cellular industry has been working on this issue - [Wireless Industry's Z-Axis Achievement Provides Accurate Vertical Location for 9-1-1 Calls](#). To cite another example, if the California Fire Chiefs Association was truly interested in having a better geolocation capability, especially in urban areas, they would be investigating the emerging [Broadcast Positioning System \(BPS\)](#) that is one of the subsystems of ATSC 3.0 television transmissions. Not to mention that NextNav's system will be proprietary and fee-for-service.

The Power Players In the 902-928 MHz Band

Radio Frequency Identification (RFID)

The application I was not aware of that is the primary user of the 902-928 MHz band in sheer numbers (billions of "devices") are the two major applications of Radio Frequency Identification (RFID). Basically, RFID is a passive electronic circuit that when "excited" by a radio transmitter, gathers enough energy from the transmission for the circuit to transmit briefly with a unique ID number.

RFID using the 902-928 MHz band is used very widely for logistics, for units as large as shipping containers, inside warehouses, and all the way down to retail use on individual products. RFID tags can be very compact and can be pasted into a hardcover book.

RFID using the 902-928 MHz band is apparently the primary method of automated vehicle tolling, such as "E-ZPass".

Both of those applications had many, *and very substantive*, professional comments submitted that if NextNav's proposal was enacted, the requirement to change the existing systems would be... incalculably expensive... with no equivalent capability to convert to. Many stated that the very high power transmissions that NextNav proposes would render the 902-928 MHz band completely unusable for their current technology. RFID depends on being able to receive a very low power "response" transmission from the RFID "tags", and anywhere near a NextNav high power transmitter, an RFID system operating on the 902-928 MHz band would probably be unable to operate, at least with the current technology.

Automatic Meter Reading

As expected, the utility industry provided comments that very large utility monitoring systems consisting of tens of millions of devices had evolved on the 902-928 MHz band, all of which would have to be replaced, and the entire radio infrastructure for those tens of millions of devices would also have to be replaced.

Z-Wave / Commercial Infrastructure Management

Another application operating in the 902-928 MHz band I was only partially aware of was [Z-Wave](#). I was aware that Z-Wave was a home automation system, but I was unaware that Z-Wave was used in commercial and industrial applications, especially management of large lighting systems in commercial office buildings, factories, and warehouses. One comment I read stated that Z-Wave is embedded deep into the infrastructure of such facilities and it would be incalculably expensive to replace, and likely impossible to use the current Z-Wave technology in the 902-928 MHz band with NextNav's high power transmitters.

Many commenters made reference that the 902-928 MHz band is a delicate balance of applications and differing technologies that have "spread out" across the 26 MHz of spectrum in the 902-928 MHz band. Most notably, commenter (that I saw), especially those that were using the 902-928 MHz band commercially, complained that 902-928 MHz was unusable. Quite the opposite - they cited their very committed, profitable, highly effective use the 902-928 MHz band for their products and systems.

Internet of Things

There were many Internet of Things comments including comments from Wi-Fi related organizations discussing the recent popularization of 802.11ah / HaLow standards, and a lot of mentions of the use of Semtech's LoRa technology (for its originally intended purpose - low bandwidth, long range control and monitoring of systems with low cost hardware).

Surprisingly, despite using the 902-928 MHz band for its [Sidewalk network](#), Amazon didn't provide its own comments (that I saw). It may well have commented as part of an omnibus comments like that of the [US Chamber of Commerce](#).

The non Power Players in the 902-928 MHz Band - Meshtastic and Amateur Radio

As far as I can tell (again, I can only do cursory surveys of names of commenters, and a few targeted searches), the only two Amateur Radio organizations who commented are Open Research Institute (ORI) and ARRL. Kudos to both of those organizations *for showing up*.

Excerpt from [ORI's comment](#) (by Ed Friesema, Michelle Thompson, and Matthew Wishek):

Current Amateur Radio use of the band includes point-to-point links, amateur television stations and repeaters, and voice repeaters. Some of the amateur repeater systems on 900 MHz are linked and serve a wide area (<https://www.scrba.org/BandPlans/33cm.htm>). Recent Amateur Radio experimental use of the band includes a variety of modern and innovative digital modes, including MMDVM and our own Opulent Voice protocol (<https://www.openresearch.institute/2022/07/30/opulent-voice-digital-voice-and-data-protocol-update/>). The open source amateur transceiver project Faraday RF was designed for 900 MHz (<https://github.com/FaradayRF/Faraday-Software>). Amateurs operate DMR and P25 repeaters in this band. Below is a list of amateur P25 repeaters just in Colorado. (https://www.repeaterbook.com/repeaters/feature_search.php?system=The%20900%20P25%20Network%20System&state_id=%25&type=systems)

Unfortunately, most of ORI's comment was attacking the validity of NextNav's claims instead of promoting more of the "Open Source innovation" that (in my opinion) would have been more impactful because of ORI's mission.

Excerpt from [ARRL's comment](#) (by David R. Siddall)

The Amateur Radio Service uses of this band are important and even critical for some purposes, but reality also is that sometimes use by Radio Amateurs has been impaired or made impossible by there being so many other transmitters operating within the band. Amateurs employ this band when technically feasible, but not infrequently Amateurs have been unable to fit in a signal without causing interference to a higher-allocated service.

It therefore raises eyebrows when Radio Amateurs read NextNav's statements that the band is under-utilized. Our operators use the band when and where they can find space, but many report that there are so many signals already in the band that they have had to search out other less desirable frequencies or, in some cases, design and build highly directional antennas and special equipment to accomplish their purpose.

Kudos to Siddall for his economy of thought and keeping ARRL's comments focused on data that's relevant to Amateur Radio where it has standing. This is the kind of "ground truth, *from standing*" that in my opinion is potentially impactful to the FCC in their deliberations. Contrary to NextNav's asserting that their reconfiguration plan would have little impact... that plan would have *enormous* impact because of the myriad... literally uncountable... uses.

Drinking from a Firehose - Too Many Comments to Process

This is my first experience trying to offer substantive comments in a popular... populist... proceeding with the FCC and trying to follow all the comments in order to formulate my substantive comments. It's essentially impossible for one person, working on one's own time, to do more than a cursory survey of all the comments, in the time allotted by the FCC. Of course, this isn't news to those professionally involved in "Communications Law" regarding the FCC. This is how / why the professional Washington DC communications Law Firms earn their high pay. Communications law firms must have an automated process to do this, or at least marshal their staff members to pore through all the comments, or perhaps hire temporary staff to comb through all of the comments in order to winnow out the few substantive comments that justify a reply comment, either negative or positive.

At least, this process is impossible for a non-professional individual in the timeframe allowed by the FCC... and have any kind of other life. The FCC's system is just byzantine to navigate - you cannot "dump" all of the comments; you can only "dump" a csv file, or have an RSS feed. You then have to open each commenter's link and save that individually, though I suppose an AI system could be used to do this process.

Individual Responses

Most of the individual responses were pleas not to disrupt the status quo of their Amateur Radio activities or their Meshtastic activities. Many Amateur Radio Operators who commented made the fundamental mistake of positing that the 902-928 MHz band was an Amateur Radio band. *That is not the case* - Amateur Radio has secondary privileges in the 902-928 MHz band, but it is not an Amateur Radio band such as 144-148 MHz and 222-225 MHz where Amateur Radio is primary.

One major goof I saw was addressing the FCC as:

Gentlemen...

This was a bit tone deaf considering that the current Chairperson of the FCC is a woman (Jessica Rosenworcel) and one of the Commissioners is a woman (Anna M. Gomez).

It was surprising to see how many commenters made pleas not to disrupt their use of Meshtastic, and most commented that a primary use of their Meshtastic systems are for emergency communications "off grid".

I saw references in comments to regional emergencies such as hurricanes, wildfires, and flooding, all of damage infrastructure, especially communications infrastructure.

First responders have access to FirstNet, a hardened, prioritized cellular service operated by AT&T. Ordinary citizens have no equivalent "network of last resort"... or at least they didn't until Meshtastic was developed. Meshtastic is being used in (preparation for) emergency scenarios by ordinary citizens because it is inexpensive to buy individual nodes and *doesn't depend on infrastructure*. Meshtastic's relay (mesh) functionality is automatic, and it can easily be deployed by individuals or in groups such as a neighborhood.

The cellular companies will say that this type of communications innovation using unlicensed spectrum isn't needed - they can "quickly" restore cellular service using emergency systems such as "Cells on Wheels". And yet, in *every* regional emergency event - hurricanes, wildfires, and flooding, cellular systems are one of the first infrastructures to be affected.

A few commenters made references to actual use cases - inter family communications in areas where cellular coverage is intermittent or often disrupted by regional emergencies such as hurricanes, wildfires, and flooding. Some examples:

[Ricky Wilson](#):

My family rely on 915mhz lora and meshtastic to help manage our domestic animals and homestead as well as alternative communications for family and friends during emergencies.

[Frank Christel](#):

Please don't allow NextNav Inc. to cripple the 902-928 MHz band's usage. Their proposal has the potential to disrupt LoRaWAN devices including Meshtastic network radios. Meshtastic technology is just now beginning to see adoption across Oklahoma. There is no less expensive way for citizens to create decentralized and community-driven communication networks. Granting exclusive or prioritized access to NextNav could stifle open-source innovation and undermine community resilience and public safety, particularly in disaster-prone or remote areas in Oklahoma.

[William T Burke](#)

Pave PAWS Beal Air Force Base has limited and eliminated many 70 centimeter systems regarding Amateur Radio in this geographical area. 902-928 MHz became the alternative and 20 years of development by civilian Amateur Radio groups have created very advanced systems in this spectrum. Interstate linking and high level coverage to provide excellent emergency assistance to the American civil population would be eliminated by this proposal. There are thousands of skilled Amateur Radio operators operating within this 26 MHz allocation. We've worked

hard over the last 20 years at no cost to the American taxpayers in development and in these uncertain times globally our efforts are highly useful in a catastrophic event. These advanced and skilled Amateur Radio groups/individuals are beyond the average appliance operators of the Amateur Radio Fraternity and deserve consideration in regard to technical excellence. This small slice of spectrum contains the most useful and reliable backup interstate communication systems within the USA. No other Amateur Radio spectrum allocation in VHF or UHF compares to what has emerged in the 902 to 928 spectrum in the past 20 years. The modified and converted commercial radio equipment occupying this slice of spectrum is mil-spec equipment by many standards. The technical workmanship by advanced Amateur Radio operators sets this spectrum allocation into a different category of advancement and functionality. It has stellar merit and deserves considerable protection. Respectfully WA6Q

There were also a number of commenters who referenced *both* their Amateur Radio and their Meshtastic use of the 902-928 MHz band. I think some of the most impactful comments will be those that reference how Meshtastic is proving to be a useful “hook” in getting people, especially young people, interested in radio technology and perhaps Amateur Radio.

A trusted advisor to Zero Retries stated that the FCC does not care about “hobbyist” use of bands like the 902-928 MHz band, especially when tens or hundreds of millions of dollars of potential new investment by NextNav and others hangs in the balance of the FCC’s decision. But self education in radio technology, and critical shortage of the US “Spectrum Workforce” does matter to the US Federal Government. Thus I think these references to Meshtastic that reference self-education do merit some consideration, such as these comments:

[Catherine Strobel](#)

Please do not interfere with the Meshtastic system. It has been such a wonderful way to get our daughter interested in digital modes as an offshoot from amateur radio. It is a good thing to grow this endeavor for our children. Thanks for your consideration.

[Dylan Durst KN6QQQ](#)

18170 Basil Drive
Tehachapi, CA 93561
September 4, 2024

Federal Communications Commission
45 L Street, NE
Washington, D.C. 20554

Opposition to FCC Public Notice August 2024 – Proposal by NextNav

I have been using the Lower 900MHz band as an unlicensed Part 15 user for almost 35 years, it was the first band I gained experience on, and lead me to a life long fascination with radio, communications and signaling that I apply what I learned daily as a professional Software Engineer, Open Source Software volunteer contributor, licensed Amateur Radio Operator and Amateur Radio Volunteer Examiner, and Meshtastic Network Operator.

Specifically, **the lower 900MHz band has been undergoing a technological Renaissance in recent years**, and ultimately lead me to become an Amateur Radio Operator. This particular bit of spectrum lives at the intersection between:

1. Extremely low cost radios with on board micro-controllers with a smooth and low-cost supply chain.(1)
2. Shared and collaborative operation with Amateur Radio operations.
3. Extremely low power operation with comparatively long range.
4. An extremely innovative community using this part of the spectrum under Part 15 more and more every day.

Overall, it provides a much better learning path than unlicensed microwave operation for those who are a novice in the field. This allows me to provide others with a path for independent discovery and education similar to the one I took when I was younger.

Nobody needs to look very far to see these applications in practice, but I can enumerate a couple applications that I use for day to day operations within my community, under Part 15 usage:

1. The WiFi Alliance’s 802.11ah (HaLow) standard
 1. Which allows for network bridging across a variety of rural situations that microwave is not a good fit for, providing a way for rural communities to side step having to using LTE and expensive proprietary platforms.
2. Meshtastic (and similar Open Source projects)
 1. A peer-to-peer meshing radio application that provides nearly unlimited educational and research opportunities in some of the most critical applications of Distributed Systems today:
 1. Peer to Peer message routing.
 2. Backwards compatible message encapsulation for long lived deployment.
 2. An extremely low cost barrier of entry, as low as \$10-\$15 to get started (if not cheaper).
 3. A completely Open Source ecosystem.
 4. Immediate entry points for Electrical Engineers, Radio Engineers and Software Engineers to collaborate, learn from each other, and contribute towards a better community operated network.(2)

Because of the overlap with Licensed Amateur Radio operations, it becomes a quick way to get started using modern networking and distributed systems technologies on radio, at such a low cost, without having to be licensed at all. The educational path does lead users into

becoming licensed, and learning and developing their skills more. There is no similar overlap in any other band. This is the current on-ramp band for innovation.

On the supply chain side of things, current Amateur Radio operators can use off-the-shelf hardware in this band for digital operation, with simple power adjustments to meet their needs, and coordinate and work with unlicensed operators collaboratively. This is not the case with unlicensed Part 15 Radio Operation, where Amateur Radio Operators need to also be Software Engineers and Electrical Engineers to change the frequency on hardware not designed for the task, or purchase much more expensive hardware, designed for the specific task. This shared region of overlap reduces waste and redundancy, and saves independent innovators money.

Without any doubt, the proposed change, would open the doors to:

1. Close the on-ramp to innovation happening in radio communications today, and close doors on educational opportunities.
2. Impact the entire Lower 900MHz Band Supply Chain, drastically increasing cost even for Amateur operators.
3. Drown out a large but unknown number of Part 15 users in this space.
4. Shut down the convergence of folks who are older and know a lot about radio, interacting with younger folks who know a lot about digital networking.

While I don't see NextNav petition as anything more than a spectrum grab at the cost of millions of everyday users of the band, and I would be incredibly surprised if their petition were approved by The Commission, I did feel the need to represent how this particular bit of spectrum has impacted my life, and how I see it impacting that of others.

Most people who are using the 900MHz band don't even know they are using it, and they certainly aren't going to be educated about using it within this short commentary period.

As for why they will need to buy a replacement item for something that has worked for years and years, the phrasing "will work with unlicensed users," in my book, means that they will just be told they can no longer use their hardware, or it just won't work anymore and they will never know why.

I support Meshtastic Communities' Formal Opposition to the change, and I will probably also support the ARRLs upcoming commentary.

Sincerely,

Dylan Durst / KN6QOQ

- (1) Any attempt to relocate usage, will increase costs.
- (2) One person having all 3 of these skill sets is already extremely rare, but those are the only individuals who would be able to innovate in this space, if this on-ramp is closed.

[Matthew Leavitt:](#)

This proposal to reshape the 900 MHz band would be extremely damaging to the purpose of amateur radio, and would stall existing projects using this band. I have been involved with my school's amateur radio club and the interest in radio has exploded in the last few years. However, we have not had as many people get their license and further their education in radio technologies because of the licensing requirement. Meshtastic and other technologies fill a gap between obtaining a license and knowing nothing about radio. It provides a way for people to easily approach radio and learn the basics by hands on experience outside of normal club meetings, at very low cost. These frequencies should remain open and free from interference to further the development of new radio technologies and interest in said technologies.

[Douglas Datwyler](#)

Comments for FCC WT Docket No. 24-240 and RM-11898

My name is Douglas Datwyler.

I urge the FCC reject the petition by NextNav to "reconfigure" the low 900 MHz band (from 902 to 928 MHz) band.

1. I am a licensed amateur radio operator (WR7O), and I believe firmly in the purposes of Amateur Radio as listed in FCC 97.1, especially 97.1(b) and 97.1(c):

- 97.1(b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

- 97.1(c) Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communication and technical phases of the art.

I am currently engaged in experiments with digital modes (FSK, GFSK) and antennas in the 902 to 928 MHz band. The NextNav action will curtail my uses of 900 MHz in part 97.

2. I have in my home an older 900 MHz DECT telephone. This phone is a lifeline for my family as cellular coverage can be spotty. This phone is likely to fail under the conditions of the NextNav system being active.

[Chris Crandon:](#)

The frequency range in question in the lower 900MHz range has been an area of huge enjoyment for me and many members of my community. I and others who share the same interests in small hobby electronics, communication and computers have spent our valuable free time (and not to mention a lot of money) building small electronic devices that we can make do a lot of really fun and cool things over these frequencies. For one, I have been able to create my own small network within my neighborhood that can connect both my wife and I

while we are at work since cell reception is lacking. I have also created a mobile gps device for both our vehicles which acts as a safety backup in case either of us need to know location or if our vehicle is stolen. There are many more things I would love to experiment with and eliminating this frequency range from amateur and hobbyist use will completely erase everything I have spend all my spare time and enjoyment creating. Our devices are hardwired to operate on this frequency and would render them completely useless. Aside from that, we don't need more corporate capture of what limited space us as hobbyists and makers have to work with! I urge anyone reading this to oppose this proposal and effectively protect this space on the RF spectrum that is growing every day in the amateur space! Thank you -Chris

[Brian Ramos:](#)

As a ham radio operator, volunteer firefighter/EMT, CERT Team member, and former Search and rescue technician; I am obviously very keen on emergency preparedness, but also innovation. I live in Napa Valley, as the name suggests, being nestled in the valley means Line of sight RF transmissions are difficult. In order to enable communications, Towers are set up throughout the valley on ridgetops to be able to communicate vital information. The Nunn, Atlas, and Lightning complex fires severely limited access to these towers, knocking out cell communications, radio broadcasts, and more for several days. The ongoing Airport Fire threatened the same. Due to the nature of centralized communication structures, Major threats exist to otherwise unpopulated land. This is resource intensive. The bandwidth in question has been used to create low powered, redundant, reliable mesh communications networks to circumvent the need for communications, an open source passion project for Hobbyists. Right now this worldwide network is in its growth phase, but if better established, would revolutionize emergency management. But Hobbyists don't generate revenue, so who cares? Well, they generate technology. Another hobby I'm a part of is building and flying multirotor sUAS (drones). A decade ago, I thought they were a fun diversion. Today, my mostly open-source hobby acts as a force-multiplier like never before, completely upturning military doctrine and revolutionizing the battlefield. By locking out American citizen's ability to tinker in their free time, American's will be on the back foot. We will be forced to rely on foreign experts to develop costly solutions to problems that are unfamiliar to everyday Americans. People who would otherwise be subject matter experts will be relegated to sending CW messages using 100 year old technology. This is how NOT to create knowledgeable young Scientists, Engineers, and technicians. Allowing technology to expand abroad, but limiting access on our home soil creates a defense risk.

Preparation for the Next Spectrum Assault

In the time allotted by the FCC, trying to publish something to Zero Retries and file my reply comments, it was impossible to read and keep track of all of the comments that came flooding in, especially after the EFF published their article and motivated many individuals to file comments.

On behalf of Amateur Radio and related radio-based communities such as personal communications (users of CB, GMRS, MURS, FRS, etc.), it's worrisome to me that it has become so tough for individuals to provide substantive comments that will receive serious consideration by the FCC. When the next band is targeted for "commercial innovation" by "sharing" or attempting a complete takeover... *and there will inevitably be a next one...* it's become apparent to me that all such a company has to do to "flood the FCC" with comments would be to create a fake organization and use social media to incentivize massive numbers of individuals to file comments. Such a situation would be a severe challenge to respond substantively.

Amateur Radio can no longer rely on the ARRL for guidance on commenting to the FCC. Increasingly, ARRL's reaction time is too slow and its perspective isn't modern enough. For example, in FCC Docket 16-239, the ARRL requested that the FCC remove archaic symbol rate limits on the HF bands so that Amateur Radio Operators could use Pactor 4 modems. But the ARRL's request was only for the HF bands - they completely ignored that archaic symbol rate limits were also in place on Amateur Radio VHF and UHF bands.

And, increasingly, ARRL only files their comments at the last minute, which doesn't provide sufficient time and guidance for others to offer their comments.

Thus I think a group needs to be formed to make ready for "the next one". The closest analogy to what I think is needed is [Archive Team](#), which is a loose affiliation of individuals with organization and resources to download and locally store portions of large online systems that are, or are likely to be removed from online access. Members of Archive Team are "on standby" until they're "activated" and then begin to "divide and download" by each individual focusing on selected portions of that system.

The part I think is most applicable to "Comment Team" is the "coordinate, divide, and download" approach. There has to be a way to automate the downloading of FCC comments, perhaps in chunks of 25 comments, and be able to centrally track whether a comment is substantive, or not, approves or disapproves of the requested change, worth filing a Reply Comment, or not, etc. Each member of "Comment Team" can check into the system, download a "chunk", upload their summarization of the comments in their chunk, etc.

Members would have to be vetted and trusted in advance. A "ringer" that's involved in "Comment Team" could cause a lot of harm.

Based on the low number of comments on Docket 24-240 filed by Amateur Radio organizations, another reason for forming "Comment Team" would be to assist Amateur Radio organizations to develop and file comments in a timely manner. They would keep various Amateur Radio organizations in mind, perhaps create a prototype comment that would reflect an organization's perspective, and then offer it to that organization so that all they would have to do to file a comment is to edit the wording and then submit that edited version. Hopefully that assistance would improve the number of Amateur Radio organizations that file comments on behalf of Amateur Radio.

###

From **Zero Retries 0170** 2024-09-20:

Reply Comments of Steven K. Stroh Regarding FCC Docket 24-240

By Steve Stroh N8GNJ

This is the text of my formal [Docket 24-240 Reply Comment filing to the FCC](#), which was acknowledged by the FCC as being received. I submitted it after business hours Eastern (Washington DC) time. I expect... hope... that my Reply Comment will be updated to "Filing Status DISSEMINATED" on Monday since the date stamp shows that it was filed on 2024-09-20, which was the deadline for Reply Comments.

Submitted 2024-09-20 via the FCC Electronic Comments Filing System as a PDF file, filename FCC_24-240_Reply_Comments_Steven_K_Stroh_2024-09-20.

Original Comment on Docket 24-240:

Abstract

I recommend to the Commission that NextNav's request to reconfigure 902-928 MHz should be denied. Denying NextNav's request and maintaining the current configuration of 902-928 MHz would serve the broadest possible public interest of the American businesses and individuals.

The Commission has received ample evidence in Comments filed by numerous organizations that *thoroughly* refute NextNav's contention that the 902-928 MHz band is "currently underutilized".

Thus the Commission is now confronted with a major decision - whether to accept NextNav's request which may create a new class of terrestrial Positioning, Navigation, and Timing (PNT) service. However, to do so would come at the well-documented enormous cost of disrupting thousands of existing, working, revenue producing systems and businesses, and obsoleting billions of radio devices, all of which depend on the current configuration of the 902-928 MHz band.

As input for the Commission in making its decision about granting NextNav's request, the Commission has also received numerous comments from individuals and small organizations such as ARRL, Open Research Institute, and Meshtastic that attest that the 902-928 MHz band fills a unique role for personal data communications, including a role in personal emergency data communications. 902-928 MHz has become a de facto "Citizen's Data Radio Service", even though such a role was not envisioned, or nor is formally recognized, as a use of the 902-928 MHz band.

In my opinion, the Commission should deny NextNav's request to reconfigure the 902-928 MHz band. Making no changes to the current configuration of the 902-928 MHz band would serve the broadest possible public interest of American businesses and individuals. Making no changes to the current configuration of the 902-928 MHz band would allow the band to remain its role as a vibrant spectrum ecosystem of many divergent uses, all of which are figuring out, dynamically, how to operate their systems while cooperating with other systems.

Background

I am an Amateur Radio Operator (callsign N8GNJ), licensed for nearly 40 years. I am a GMRS user (callsign WRPS598). I also had a Citizens Band license - callsign KBFZ8271. My professional background is an Electronic Technician, computing System Administrator, Network Manager, and Technology Writer. I live in Bellingham, Washington. I write a weekly independent newsletter called Zero Retries (www.zeroretires.org) that highlights technological innovation occurring in Amateur Radio worldwide.

My primary interest within Amateur Radio is operating data communications modes, experimentation, and helping to develop, prove out, and document new radio-based data communications modes. In Zero Retries every week, I document the remarkable evolution in radio technology occurring in Amateur Radio based on new technologies such as Software Defined Radio (software and hardware), Digital Signal Processing, novel and new antenna techniques, use of multiple inexpensive receivers and many other fascinating new approaches and technologies applied to old problems in radio communications.

In short, I posit to the 2100+ readers of Zero Retries that Amateur Radio is a literal license to experiment with radio technology, with low barriers to entry, especially in the Amateur Radio VHF / UHF bands of which 902-928 MHz is one.

While my primary standing to comment on Docket 24-240 is my perspective as an Amateur Radio Operator, I also feel qualified to comment on Docket 24-240 as a member of the general public (a citizen) who uses 902-928 MHz for experimental and education purposes, as well as mundane uses of 902-928 MHz such as a cordless telephone that was specifically chosen for its operation on 902-928 MHz to not be interfered by my wireless systems operating on 2.4 GHz.

902-928 MHz Has Become the Starting Point of Personal Experimentation and Self Training in Radio Technology

In past eras, the Amateur Radio service was regarded as the "entry point" for individuals that were interested in doing personal experimentation and self training in radio technology.

For various reasons (most of which aren't germane to this discussion), in the last half-decade, experimentation with radio technology using data communications in 902-928 MHz has become the new "entry point". Some primary reasons for this change are:

- No individual license (Amateur Radio, or GMRS) is required,
- Equipment to do such experimentation, typically with (free) Meshtastic software operating on LoRa hardware is inexpensive,
- Individuals can self-educate because the information about using Meshtastic and creating individual nodes and relay stations is widespread, and
- Individuals can form their own electronic communities using Meshtastic, either for family use, or community use, or on the basis of shared interests.

Some of these Meshtastic users, after having hands-on experience with radio technology, will go on to become licensed for Amateur Radio. Others will prefer to continue their experimentation and usage in the "unlicensed, more flexible" realm of the 902-928 MHz band and other unlicensed bands because of various restrictions on Amateur Radio operations, including that encryption cannot be used (with very limited exceptions) on Amateur Radio.

With that experience, those users will have a better understanding of the fundamentals of radio technology, and be better equipped than 99% of the public in potentially becoming a member of the "Spectrum Workforce".

Growing the Spectrum Workforce

As documented by the Biden Harris Administration's November 13, 2023 National Spectrum Strategy (NSS) document, Pillar Four - Expanded Spectrum Expertise and Elevated National Awareness, there are three Strategic Objectives:

- Strategic Objective 4.1 | Attract, train, and grow the current and next-generation spectrum workforce.
- Strategic Objective 4.2 | Improve policymakers' understanding of spectrum considerations.

- Strategic Objective 4.3 | Improve the public's understanding of radio frequency spectrum and raise awareness of its role in everyday life.

I posit to the Commission that though the Commission and its actions are not specifically mentioned in the NSS, Pillar Four, or the three Strategic Objectives, the Commission by its actions in Docket 24-240 will determine the continued usability of the 902-928 MHz band, which will have a significant influence on the three Strategic Objectives, as discussed below.

Strategic Objective 4.1 | Attract, train, and grow the current and next-generation spectrum workforce.

"Attract" is directly related to the continued usability of the 902-928 MHz band for personal experimentation and usage for data communications. Unlicensed devices such as Meshtastic, operating in the 902-928 MHz band offer a low barrier to entry for radio technology experimentation, and that low cost is especially important to encourage those in disadvantaged situations to be able to gain hands on experience with radio technology.

While Meshtastic is a great "entry point" for use of 902-928 MHz because of its ease of use and low cost, there are other systems that can be personally experimented with in the 902-928 MHz band:

- 802.11ah / HaLow - much faster data communications than Meshtastic, similar range, and still relatively low cost. The 802.11ah network protocol was specifically designed for < 1 GHz bands worldwide, but one of the primary bands is the "Americas" 902-928 MHz band. The HaLow certification insures interoperability between different manufacturers, and thus a diversity of manufacturers, functions, price points, form factors, from embeddable boards to complete access points similar to conventional Wi-Fi units.
- Z-Wave is not only used for personal / home automation, but it scales up in to commercial and industrial systems. One can experiment with Z-Wave technology in their home, and apply that knowledge directly in a professional career.
- Amateur Radio offers nearly unlimited potential for personal experimentation with radio technology, including in the 902-928 MHz band. While many Amateur Radio commenters describe how their 902-928 MHz repeater systems are "forced to the band edges where the noise is lowest"... those repeaters are typically using analog Frequency Modulation (FM) technologies that generally require a "clear frequency". Digital systems deal with interference much better because they can employ Forward Error Correction (FEC). Thus Amateur Radio is a "proving ground" for dealing with interference in a crowded band without resorting to "brute force" methods required for older technologies to deal with interference such as "clearing out all other users".

One example of innovation in Amateur Radio is a new Digital Voice and Data system called the M17 Project (<https://m17project.org/>) which is an entirely open source system designed by Amateur Radio Operators for Amateur Radio. M17 is attracting new experimenters into Amateur Radio which were previously disinclined to do so because current Digital Voice repeaters use proprietary technology. Because of its open source nature, M17 is innovating rapidly. One example is the experimental addition of cryptographic signatures (not encryption) of transmissions so that "spoofing" of transmissions can be detected.

Strategic Objective 4.2 | Improve policymakers' understanding of spectrum considerations.

"Policymakers' understanding" speaks directly to the Commission's role in understanding the rapidly improving capabilities of radio technology and the ability for different radio technology systems to coexist in the same spectrum.

In the constraint of "the entirety of the usable electromagnetic spectrum has been allocated to some service", any new radio based services will inevitably have to share spectrum with other uses, or undergo a disruptive reconfiguration.

As American society has converted from wired communications infrastructure to radio based communications infrastructure, the economic cost of the latter approach has reached the point of being non-feasible. Thus "spectrum sharing" is now the most cost-effective and efficient system of creating new radio services.

The Commission has implemented a number of innovative spectrum sharing systems such as CBRS, sharing the portion of the 5 GHz band used for Weather RADAR with Wi-Fi, unlicensed use of the 6 GHz band, and TV White Space to use vacant television broadcast channels for broadband Internet access.

Each of those systems have required highly proscriptive rules or elaborate new infrastructure. To use the 5 GHz Weather RADAR spectrum required new generations of Wi-Fi chipsets that would detect Weather RADAR transmissions and shift off those frequencies automatically. To allow the use of military RADAR frequencies around 3.5 GHz required the deployment of a vast network of receivers, infrastructure, and the creation of a "permission requested to use this channel" protocol. Similarly, TV White Space systems required the deployment of a similar infrastructure for a "permission requested to use this channel" protocol.

But none of that is used in the 902-928 MHz band. There is no mandated protection built into chipsets, nor is there any external "permission requested" protocols or infrastructure. Within the 902-928 MHz band there are systems *as diverse as...*

- RFID chips for retail and warehouse logistics,
- Extensive networks for automatic toll collection,
- Internet of Things networks such as Z-Wave, Amazon Sidewalk network, and LoRa,
- Experimenters deploying Meshtastic and 802.11ah / HaLow networks,
- Amateur Radio "Earth Moon Earth" operations operating at very high power (but focused on the Moon).

All of those very diverse uses are demonstrably coexisting with the 902-928 MHz band., again, with no mandated protection built into chipsets, nor any external "permission requested" protocols or infrastructure.

Another example of innovation in the 902-928 MHz band is spectrum sharing "underlay" techniques such as Frequency Hopping Spread Spectrum. FHSS was one of the first spread spectrum systems in use when the ISM bands were allowed to be used for communications. FHSS use in 902-928 MHz continues to the present day. FHSS is highly effective, but its potential data rate is less than what can be accomplished with other technologies such as OFDM and DSSS, so its use is less "visible". Demonstrably, FHSS technology works by its continued use in the 902-928 MHz band, and potentially could

be used in other bands as an underlay using faster hopping patterns, lower dwell times, and lower transmit power enabled by vastly improved digital system gain. Bluetooth has become even more usable over time in the 2.4 GHz band despite that band being used very aggressively by Wireless LANs such as Wi-Fi, and even analog “wireless television” cameras.

How is this possible? How can such a “free for all, ad-hoc, anything goes” spectrum sharing model be applied to future needs for new services when “virgin spectrum” can no longer be allocated or created by reallocation of existing services?

In the 902-928 MHz band as currently configured, the Commission has a perfect “laboratory” for observing rapid technological evolution in spectrum sharing. It only has to carefully observe what is actually happening in that band, perhaps by setting up a “spectrum observatory” in a selected, representative city such as Columbus, Ohio. Provably the current model of regulation in the 902-928 MHz band is working well. All that the Commission has to do to “continue the experiment” is to not radically disturb the unique spectrum ecosystem in the 902-928 MHz band.

Strategic Objective 4.3 | Improve the public’s understanding of radio frequency spectrum and raise awareness of its role in everyday life.

In my opinion, this Objective *could not be more directly related* to the situation represented by Docket 24-240.

Thanks to media mentions such as from Meshtastic, Electronic Frontier Foundation, ARRL, (and, modestly, Zero Retries) and notifications from the *many* commercial users of 902-928 MHz, the (techie) “public’s understanding of radio frequency spectrum and raise awareness of its role in everyday life” has quickly become prominent.

The most impactful action that the Commission can undertake in supporting the Biden Harris Administration’s National Spectrum Strategy, Pillar 4, Strategic Objective 4.3 to improve the public’s understanding of radio frequency spectrum and raise awareness of its role in everyday life...

... is to allow the continued, current use by the public, using unlicensed (Part 15) equipment, of the entirety of 902-928 MHz band. To use a resource is to appreciate it, understand it, and support it, be it roads, schools, public parks... or spectrum.

If there are not places in the electromagnetic spectrum where the public can use spectrum directly, hands-on, experimentally, with low barriers to entry (even lower than Amateur Radio, which requires a technical examination, and a lot of “domain knowledge”) then we will be relegated to be a nation of “app users” with no appreciation or understanding of the role of spectrum in everyday life.

And if that comes to pass, we will be poorer and less secure and less self-sufficient in the primary technology of radio technology.

In Conclusion

In Docket 24-240, NextNav has proposed a radical reconfiguration of the 902-928 MHz band. If adopted, NextNav’s reconfiguration will be highly disruptive, and in most cases destructive (no practical or cost effective way to adapt to the reconfiguration) to hundreds of systems and billions of individual units that use 902-928 MHz daily.

Beyond the currently incalculable financial cost of disrupting commercial systems that currently use the 902-928 MHz band, and the obsolescence of billions of electronic units, if the Commission reconfigures the 902-928 MHz band per NextNav’s request, the American public will suffer an enormous loss of opportunity for personal use of the 902-928 MHz band.

The use of 902-928 MHz as a de facto “Citizens Data Radio Service” would be severely impacted. If the band were reconfigured per NextNav’s request, “cramming” all unlicensed use into a mere 11 MHz (907-918 MHz), it would not be cost-effective for most unlicensed uses to attempt to adapt.

Such a situation would be the commercial equivalent of “mere app users”, buying service on other systems, with no resiliency or independent operations capability. Imagine a commercial lighting system that currently uses Z-Wave on 902-928 MHz that was forced to be converted to use cellular technology. Then we’d be in an absurd situation where if the cellular network were unavailable... *you cannot even turn the lights on*. Even worse, electric utilities, or water utilities, or gas utilities could not monitor their local distribution systems for service outages, or breaks (bad for water main breaks, catastrophic for gas pipeline breaks).

Managing the Radio Spectrum for the Broadest Possible Public Interest

In the most broad perspective of the Commission’s “mission”, it is to manage the portion of the electromagnetic spectrum that is “usable for radio communications” to the highest and best use for the broadest possible public interest. In my initial comment, I cited the easiest example of radio spectrum management highest and best use of the broadest possible public interest was sinking of the Titanic. The subsequent rescue of passengers, in time, before they perished from exposure, was the result of then new radio technology. The aftermath of the Titanic sinking required new management of radio spectrum to make ship communications reliable. That management required making some hard decisions about “highest and best use” of competing user communities (such as segmenting radio broadcasting and ship communications into separate portions of the radio spectrum) and choosing between competing technologies to effectively use limited radio spectrum.

In Docket 24-240, the Commission is again tasked with making decisions about “highest and best use” of competing user communities and competing technologies to effectively use the limited radio spectrum of the 902-928 MHz band. In the totality of the unique nature of the 902-928 MHz band, the diverse users and systems that have evolved, and thrived, and profited in the 902-928 MHz band as it is currently configured...

In my opinion, NextNav’s proposed reconfiguration of 902-928 MHz is not in the broadest possible public interest.

Thus I recommend to the Commission that NextNav’s proposed reconfiguration of 902-928 MHz in Docket 24-240 *should be denied*.

Signed,
Steven K. Stroh
P.O. Box 30725
Bellingham, Washington, USA

##

From *Zero Retries* 0171 2024-09-27:

My FCC Docket 24-240 Reply Comments Filed

Well, I got my [Docket 24-240 Reply Comments](#) submitted, but I did so after business hours in Washington DC, *but still well within "2024-09-20"*. I wasn't quite sure if my submission would be considered to have been submitted that day, but the timestamp on my submission, processed the next business day (2024-09-23) says 2024-09-20, and the status of my submission says

Filing Status DISSEMINATED

So I think my Reply Comments will be duly considered.

Comments are *still* coming in (more than 1800 now), nearly a week after the 2024-09-20 deadline, and those late comments are being marked as DISSEMINATED.

NextNav isn't dissuaded by the thousands of negative comments. [Their Reply Comment](#) said, in part:

The Commission will of course carefully consider the feedback from all commenters, as will NextNav, but the key takeaway is this: No one else has proposed a credible solution to the widely recognized and increasingly urgent problem that the United States has no widescale TPNT service to complement and back up GPS where the GPS signal is obstructed or when outages occur. Even many of those opposed to NextNav's Petition acknowledge that a terrestrial complement and backup to a satellite-based PNT service is critically important to safeguarding U.S. national security, public safety, economy, and way of life. As there is no prospect of the U.S. government funding a standalone terrestrial PNT network, NextNav offers the only concrete opportunity to enable a widescale terrestrial PNT service—one that has a clear path to availability in consumer devices such as cellphones—without spending taxpayer dollars.

NextNav is really disingenuous here - there *were other* "credible solution[s]" discussed in the submitted comments. NextNav's proposal is *not* the only credible *potential* solution to this issue. I, for one, think we should rebuild the LORAN ([eLORAN](#)) system.

I've been amazed before, and this is yet another example, of the seemingly inexhaustible budgets available to communications law firms to aggressively lobby the FCC when there's a credible prospect of getting the FCC to (however reluctantly) agree to allocate "free spectrum". If the FCC declines NextNav's proposal... they (or a successor, who buys NextNav's assets out of bankruptcy) *will be back*, eventually.

Some Zero Retries readers from outside the US wrote to me basically saying:

What a screwed up system the US has with the FCC when a private company with a specious claim, who hasn't really done anything to prove out their technology claims, can credibly threaten to bankrupt hundreds of companies and obsolete billions of devices.

I couldn't offer any argument to their assessment.

#

From *Zero Retries 0177* 2024-11-08

Rough Week... Leading to a Rough Rest of Decade

Update - I'm choosing to redact this article to keep it focused on 902-928 MHz and NextNav; if you'd like to read the full un-redacted article, click the link.

...

However, looking ahead, regardless of our individual political leanings, I speculate that Amateur Radio will be impacted by change of administrations, and a change of perspective about radio technology within the US government.

...

- Another change I fear from the FCC is that the new administration may well be much more receptive to changes proposed by NextNav for the 902-928 MHz band in FCC Docket 24-240. If NextNav's Docket 24-240 proposal is enacted, NextNav has made a business case and has promised (?) massive investment in new radio technology infrastructure, and revenue for their proprietary services. Amateur Radio being a secondary priority in this reconfiguration of 902-928 MHz may find the band effectively unusable, especially for traditional analog FM repeaters.

...

But mostly, I fear that in this new administration, radio technology businesses of all kinds will be emboldened to make the argument, as NextNav just did for the 902-928 MHz band, that Amateur Radio and other non-primary users of various bands, should be subject to being downsized / de-prioritized, or simply de-allocated in favor of speculative new radio services in the name of national security or simply potentially profitable new services. For example, if Amateur Radio can effectively share 420-450 MHz with various US government services, likely a well-funded new commercial service could make the case that they could operate in 420-450 MHz as effectively as Amateur Radio does now.

...

Leave a comment

Share

ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

[M17Web: Listen to M17 Reflector Traffic in your Browser](#)

Andreas Schmidberger OE3ANC on the M17 Project website:

Why I built [m17web](#)

When introducing my fellow Austrian hams to M17, I kept hearing the same question: “**How does it sound?**” This coincided with my desire to experiment with **Rust** and **WebAssembly**, creating the perfect opportunity to build a tool that would answer this question while expanding my programming skills.

How it works

m17web consists of three main components connecting to mrefd and working together to bring M17 digital voice to your browser. The system listens to UDP traffic from M17 reflectors, routes it through a proxy server, decodes the audio in the browser using WebAssembly, and presents it through a clean web interface—all without requiring any special hardware or software installation.

Can't get a much lower barrier to entry for some exposure to M17 than this!

Kudos to OE3ANC!

###

Two New Books on Software Defined Radio

[Jeff Davis KE9V on his blog](#):

New Textbook Featuring GNU Radio

GNU Radio is the leading open-source software toolkit for developing SDR systems, an increasingly viable and even critical tool for a new generation of radio frequency communication engineers. Communication Systems Engineering with GNU Radio provides an accessible overview of this toolkit and its applications. Beginning with the fundamentals of using GNU radio for digital signal processing, the volume then moves to the practicalities of decoding data and the advantages of accessing raw data normally unavailable in hardware-defined radio frequency receivers.

and...

[Practical SDR: Getting Started with Software-Defined Radio](#)

Discover the exciting world of software-defined radio (SDR) through this hands-on, beginner-friendly introduction.

Whether you're a hobbyist interested in exploring the airwaves, a student learning about wireless communications, or an engineer looking to prototype RF designs, Practical SDR will help you master the fundamentals of software-defined radio.

You'll build virtual radio receivers on your computer, then extract audio from real AM and FM signals; learn how amplitude modulation works by building an AM radio; understand signal filtering by crafting clean FM reception; and grasp complex topics like IQ sampling. You'll use the intuitive GNU Radio Companion interface to create working radio systems piece by piece, then move on to building functional AM and FM receivers, and even design your own radio transmitter.

The latter book is more affordable than the former and is already on order.

Both look interesting... you might get the impression that Software Defined Radio technology is a hot topic lately.

There is also [Software-Defined Radio for Engineers](#) by Travis F. Collins, Robin Getz, Di Pu, and Alexander M. Wyglinski. This 375 page ebook, available from the Analog Devices website, was published in 2018, and has this notation:

Analog Devices perpetual eBook license – Artech House copyrighted material.

###

Chasing RFI Waves Series

Back in 2005, I started writing what I'd planned to be a non-fiction book about NRAO (the National Radio Astronomy Observatory), based on visits, photos and interviews to that very interesting place. My contact was Wesley Sizemore, NRAO's public face and “Keeper of the Quiet”, a term which will make more sense to you once you read more about NRAO and the NRQZ (the National Radio Quiet Zone).

I didn't get to finish the book. Life intervened, I got caught up in other things and my photos, interviews and written pages (there are quite a few of them) sat in my Documents folder, gathering digital dust ever since (it's been about seven years now)

Rather than let it all sit there till oblivion, I thought it'd do more good published, unfinished as it is. If I ever get the chance to make subsequent visits and finish writing the whole story, great. If not, here it is for your enjoyment. NRAO is a neat place doing interesting research into things that have always obsessed humans: outer space, planets, aliens, etc.

- [Part One](#)
- [Part Two](#)
- [Part Three](#)
- [Part Four](#)

- [Part Five](#)
- [Part Six](#)
- [Part Seven](#)

Updated 5/25/19: I have published a re-edited digital edition of “Chasing RFI Waves” which is available on the Apple Books and Google Play online stores. Check it out!

The articles include some great photos of the NRAO dishes. I want to read the entire series.

###

[Voice of the Mesh Podcast](#)

A podcast about everything Meshtastic, related technologies, projects and anything adjacent that’s just plain interesting.

Disclaimer: Voice of the Mesh is not sponsored or endorsed by Meshtastic LLC.

I haven’t listened to the two episodes posted to date, but it sounds interesting. Queued up in my podcast player for the long plane flight this week.

###

Director of Radio Solutions at Stealth Startup

That mention greeted me when I briefly check LinkedIn this week.

The person in question is Matt Ettus N2MJI¹. If you know (of) N2MJI, you understand what a potentially big deal this is... *whatever* “Stealth Startup” actually is. First it’s cool that there are radio-related stealth startups still being formed. Second, with N2MJI involved, it’s *gotta* be interesting.

Leave a comment

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See the **Zero Retries Boilerplate** page for significant acknowledgements and other information relevant to Zero Retries. For new readers of Zero Retries, that page, and the **About Zero Retries** page has useful information to check out.

My ongoing *Thanks* to:

Tina Stroh KD7WSF for, well, *everything*!

Jack Stroh, Late Night Assistant Editor Emeritus

Shrek Stroh, Late Night Assistant Editor In training

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This issue released on 2025-03-14

Footnotes for this Issue

To see the relevant sentence for the footnote, just click the footnote number.

[1](#)

If you're curious, go to the search box on the Zero Retries homepage and search for N2MJI to see just some references to his work. I hold N2MJI in immense esteem.